



August 31, 2016

Ms. Diane McDaniel  
Department of Environmental Protection  
Southwest Regional Office  
400 Waterfront Drive  
Pittsburgh, PA 15222

Mr. Griff Miller  
USEPA Region 3  
RCRA Corrective Action (3LC30)  
1650 Arch St  
Philadelphia, PA 19103

**Re: Raccoon Creek Groundwater Sampling Report  
Second Quarter 2016  
Former Lyondell Beaver Valley Site  
Lyondell Environmental Custodial Trust  
Potter Township, Pennsylvania**

Dear Ms. McDaniel and Mr. Miller:

On behalf of the Lyondell Custodial Trust (Trust), Tetra Tech, Inc. (Tetra Tech) has prepared this letter to summarize the results of the Second Quarter 2016 Raccoon Creek Area groundwater sampling and thermal image collection event at the Former Lyondell Beaver Valley site (Site) in Potter Township, Pennsylvania. The sampling event was conducted at the request of the Pennsylvania Department of Environmental Protection (PADEP) and the United States Environmental Protection Agency (USEPA). This work was conducted in accordance with the approved 2016 Sampling Work Plan dated April 27, 2016 and the work plan addendum dated May 25, 2016.

### **GROUNDWATER SAMPLING SUMMARY AND RESULTS**

Tetra Tech mobilized to the Site on June 20, 2016, to conduct the groundwater sampling event. During this event an on-site staff gauge (SG-1) was installed in Raccoon Creek to record the surface water elevation. All monitoring wells and the staff gauge were surveyed by a professional surveyor for location and elevation on June 21, 2016. Figure 1 shows the locations of all the existing wells and the newly installed staff gauge in Raccoon Creek.

Raccoon Creek flow conditions were documented on June 20, 2016. The documentation included data from the staff gauge and available flow and water level data from the following USGS gauging stations that are near the Raccoon Creek Area.

- USGS gauging station 03108000 at Raccoon Creek at Moffatts Mill, PA [http://waterdata.usgs.gov/usa/nwis/uv?site\\_no=03108000](http://waterdata.usgs.gov/usa/nwis/uv?site_no=03108000)
- USGS gauging station 03108010 at Fishpot Run near Shippingport, PA (tributary to Raccoon Creek) [http://waterdata.usgs.gov/nwis/dv/?site\\_no=03108010&PARAmeter\\_cd=00060](http://waterdata.usgs.gov/nwis/dv/?site_no=03108010&PARAmeter_cd=00060)



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- USGS gauging station 03108490 on Ohio River above Montgomery Dam & Locks at Ohiovie, PA (downstream to Raccoon Creek on Ohio River but in the same pool as Raccoon Creek) <http://waterdata.usgs.gov/usa/nwis/uv?03108490>

The elevation of the stream based on measurement data from staff gauge SG-1 was 682.58 feet above mean sea level. Table 1 presents the staff gauge data. Graphs depicting the USGS gaging station data are included in Attachment 1. Based on a review of the USGS gauging information, the conditions in Raccoon Creek were near the seasonal median for discharge (Attachment 1; USGS station at Moffatts Mill).

Groundwater levels and the presence of light non-aqueous phase liquid (LNAPL) were measured using an interface probe. Water levels were recorded to the nearest 0.01 foot. The depth to groundwater ranged from 7.25 feet below the top of casing (btc) in MW-163S to 47.89 feet btc in MW-501D. LNAPL was present in MW-161 at a thickness of approximately 0.01 feet. Table 1 presents the well gauging data.

Groundwater potentiometric contour maps were completed for both the November 2015 and June 2016 synoptic water level events. Figure 2 depicts the shallow groundwater potentiometric surface map for the November 2015 event and Figure 3 depicts the shallow groundwater potentiometric surface map for the June 2016 event. The groundwater flow direction as measured in both events is southwest to south-southwest and flowing in a direction away from and perpendicular to Raccoon Creek. The surface water elevation in Raccoon Creek as measured in the June 2016 event is higher relative to the potentiometric surface data in all wells measured in the Raccoon Creek Area with the exception of MW-120 (Table 1). This indicates that Raccoon Creek is potentially a losing stream in a large portion of the Raccoon Creek Area.

On June 20 and 21, 2016, groundwater samples were collected from MW-120, MW-159, MW-160, MW-162, and MW-163S with the use of a bladder pump utilizing low-flow techniques. The sample from MW-501S was collected using a peristaltic pump because a bent well casing prohibited the insertion and use of a bladder pump. MW-161 was not sampled due to the presence of LNAPL. Field parameters were measured and recorded during purging and at the time of sample collection. Groundwater field parameters (pH, specific conductance, temperature, turbidity, and dissolved oxygen) were measured using a Horiba Model #U-52. A well was considered stabilized and ready to sample once three consecutive readings were within the following criteria:



Field Parameter	Stabilization Criteria
pH	+/- 0.1 standard pH unit
Temperature	+/- 3%
Specific Conductance	+/- 3%
Dissolved Oxygen	+/- 10%
Turbidity	+/- 10%
Oxidation-Reduction Potential	+/- 10 mV

The final field parameter readings are summarized in Table 2. Field data log sheets from the groundwater samples collected are presented in Attachment 2.

The samples were analyzed for:

- Benzene, Ethylbenzene, Toluene, and Xylenes (BTEX) using EPA Method 8260
- Target Analyte List (TAL) dissolved metals using EPA Method 6010 (7470 for mercury)

The samples were sent to TestAmerica Laboratories, Inc. in Pittsburgh, PA for analysis.

A summary of the analytical results is described below. The analytical results are tabulated in Table 3 for chemical compounds detected in at least one well, and Figure 4 depicts the chemicals of concern above Pennsylvania Act 2 Statewide Health Standard, Residential, Used Aquifer, TDS  $\leq$  2500 Medium Specific Concentrations (MSCs) criteria. The laboratory analytical reports are presented in Attachment 3. Attachment 4 contains a table that summarizes all chemical analyses run for samples collected at the Site.

Only one volatile organic compound (VOC), benzene, was detected at concentrations over the aforementioned MSCs. Benzene exceeded the MSC criteria in four wells sampled (MW-159, MW-162, MW-163S, and MW-501S), ranging in concentration from 100  $\mu\text{g/L}$  in MW-162 to 66,000  $\mu\text{g/L}$  in MW-501S.

In general, benzene concentrations in three wells (MW-159, MW-163S, and MW-501s) were consistent with the November 2015 data. Benzene concentrations in the remaining three wells (MW-120, MW-160, and MW-162) were lower than the November 2015 data.

Twenty-one dissolved metals (aluminum, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected at concentrations above the laboratory detection limits; however,



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only eleven metals (arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, nickel, thallium, vanadium, and zinc) were detected at concentrations over MSCs.

Purge water was containerized in 55-gallon drums and will be disposed of at an appropriate facility, in accordance with regulations.

### **THERMAL IMAGE COLLECTION**

At the request of PADEP and USEPA, thermal images were collected along Raccoon Creek on July 6, 2016. The thermal images were collected to potentially optimize the sampling locations planned to be collected during the August 2016 surface water and sediment sampling event.

A handheld thermal imaging camera (Testo 875 series) was utilized. Numerous thermal images were taken from a boat to identify potential locations where groundwater may be discharging to Raccoon Creek. The use of thermal imaging for this application has been well documented by the USGS (<http://water.usgs.gov/ogw/bgas/thermal-cam/>), but has not been applied to this Site.

The groundwater temperature in the Raccoon Creek Area monitoring wells was approximately 54 to 57 degrees Fahrenheit (F). The surface water temperature in Raccoon Creek was significantly warmer (approximately 73 to 75 degrees F) as measured by the thermal camera. The thermal imaging camera was able to detect this temperature differentials along Raccoon Creek in some areas (images 798 and 818a through 818d). However, images collected near the Raccoon Creek Soil Cover/Capped Area, images 800 thru 812, do not depict temperature differentials indicative of groundwater discharge to Raccoon Creek. This supports the possibility that groundwater does not discharge into Raccoon Creek and that Raccoon Creek is a losing stream as suggested by the groundwater elevation data described above.

The thermal imaging camera detected significant temperature differentials at two locations outside of the Raccoon Creek Soil Cover/Capped Area. For example, at image location 798 shown in Attachment 5, the discharge from the BASF outfall was detected at higher temperatures with respect to the surface temperatures in Raccoon Creek. At image 818, also shown in Attachment 5, upgradient of the Soil Cover/Capped Area, a seep from the bedrock outcrop had a temperature of 54 to 56 degrees F that was significantly lower than the temperature in Raccoon Creek of 73 degrees F. Several images (images 818a through 818d shown in Attachment 5) were collected at this location to document this temperature differential.

Note that this instrument only measures temperature at the surface and cannot be used to determine if groundwater is discharging to Raccoon Creek at depth. Also note, there are several images with indications that the surface of the water is slightly cooler (within 1 to 2 degrees F) close the surface water/land interface. These temperature differentials are likely due to thermal reflection from the cooler shaded area on shore and is not an indication of groundwater discharge.

During the August sampling event, thermal images will be collected to further evaluate these preliminary observations. The thermal data collected on July 6, and additional thermal data collected in



August, may be used to decide where the final surface water/sediment sampling locations will be collected.

## **CONCLUSION**

Tetra Tech is pleased to have the opportunity to continue to serve the Trust, PADEP, and USEPA on this project. The next round of groundwater sampling along with the collection of surface water and sediment samples will be conducted in August 2016. Tetra Tech looks forward to discussing the 2<sup>nd</sup> and 3<sup>rd</sup> quarter sampling results with the DEP and EPA in early fall. Please contact me at (412) 921-8398 or at [Keith.Henn@tetratech.com](mailto:Keith.Henn@tetratech.com) if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Keith Henn".

Keith Henn, PG  
Senior Project Manager

### Attachments:

- Tables 1 through 3
- Figures 1 through 5
- Attachments 1 through 5

cc: Lyondell Environmental Custodial Trust (w/attachments)  
Oscar Vazquez-Martinez, PADEP (w/attachments)  
Michael Kovacich, Tetra Tech, Inc. (w/attachments)  
Jonathan Aglio, Tetra Tech, Inc. (w/attachments)  
Derek Amidon, Tetra Tech, Inc. (w/attachments)

## **TABLES**

**Table 1**  
**Groundwater Gauging Data**  
Former Lyondell Beaver Valley Site  
Potter Township, Pennsylvania

Location	Top of PVC/Pipe Elevation <sup>(1)</sup>	Depth to LNAPL (ft) <sup>(2)(3)</sup>	Depth to Water (ft) <sup>(3)</sup>	Groundwater Elevation <sup>(1)</sup>	Depth to LNAPL (ft) <sup>(2)(3)</sup>	Depth to Water (ft) <sup>(3)</sup>	Groundwater Elevation <sup>(1)</sup>
9-Nov-15		20-Jun-16					
MW-120	708.34	NM	25.80	682.54	0.00	25.48	682.86
MW-159	706.92	NM	24.45	682.47	0.00	25.24	681.68
MW-160	697.17	NM	17.29	679.88	0.00	17.09	680.08
MW-161	700.71	19.25	19.26	681.45	19.07	19.08	681.63
MW-162	702.08	NM	22.44	679.64	0.00	22.07	680.01
MW-163S	687.49	NM	7.42	680.07	0.00	7.25	680.24
MW-501S	698.66	NM	17.78	680.88	0.03	17.46	681.20
MW-501D	698.66	NM	48.10	650.56	0.00	47.89	650.77
SG-1	683.73	NA	NA	NA	NA	1.15	682.58

Notes:

1 - Feet Mean Sea Level

2 - Light Non-Aqueous Phase Liquid

3- Measured Depth Below Top of Casing

NA = Not Applicable

NM = No Measurable LNAPL

**Table 2**  
**Groundwater Chemistry Field Measurements**  
**June 2016 Sampling Event**  
Former Lyondell Beaver Valley Site  
Potter Township, Pennsylvania

Well ID	Date	Temperature (°C) <sup>(1)</sup>	pH (SU) <sup>(2)</sup>	Specific Conductivity (mS/cm) <sup>(3)</sup>	Turbidity (NTUs) <sup>(4)</sup>	ORP (mvolts) <sup>(5)</sup>	DO (mg/L) <sup>(6)</sup>
MW-120	06/20/16	12.05	6.15	2.35	5	-33.0	0.35
MW-159	06/21/16	14.29	5.75	2.02	15	-94.0	5.90
MW-160	06/20/16	12.61	6.76	1.33	13.5	-70.0	1.03
MW-162	06/20/16	12.72	6.38	1.82	8.1	-104.0	0.21
MW-163S	06/21/16	13.46	4.40	2.42	19.7	-48.0	2.06
MW-501S	06/21/16	15.00	2.69	8.55	3	194.0	0.58

Notes:

Field parameters measured at the conclusion of purging with a Horiba water quality instrument.

<sup>(1)</sup> °C = degrees celcius

<sup>(2)</sup> SU = Standard Unit

<sup>(3)</sup> mS/cm = millisiemens/centimeter

<sup>(4)</sup> NTUs = Nephelometric Turbidity Units

<sup>(5)</sup> mvolts = millivolts

<sup>(6)</sup> mg/l = milligrams/liter

**Table 3**  
**Groundwater Analytical Results**  
**November 2015 and June 2016 Sampling Events**  
Former Lyondell Beaver Valley Site  
Potter Township, Pennsylvania

LOCATION:	PADEP Residential Used Aquifer MSC <sup>(1)</sup>	MW120	MW120	MW120	MW-120	MW159	MW-159	MW160	MW-160
SAMPLE ID:		MW120	MW120-AVG	MW120-D	MW-120	MW159	MW-159	MW160	MW-160
SAMPLE DATE:		20151109	20151109	20151109	20160620	20151110	20160621	20151111	20160620
SAMPLE CODE:		ORIG	AVG	DUP	ORIG	ORIG	ORIG	ORIG	ORIG
MATRIX:		GW	GW	GW	GW	GW	GW	GW	GW
<b>DISSOLVED METALS (UG/L)</b>									
ALUMINUM	NC	37 J	38.5	40 J	200 U	200 U	49 JB	200 U	200 U
ARSENIC	10	50 U	30 U	10 U	51	10 U	50 U	4.7 J	10 U
BARIUM	2000	60 J	60.5	61 J	160 J	42 J	38 J	62 JB	52 J
BERYLLIUM	4	4 U	0.24 J	0.24 J	4 U	4 U	4 U	4 U	4 U
CADMIUM	5	5 U	5 U	5 U	5 U	0.29 J	0.32 J	5 U	5 U
CALCIUM	NC	370000 B	375000	380000 B	110000	220000 B	240000	130000	69000
CHROMIUM	100	30	34	38	2.8 J	30	19	5 U	5 U
COBALT	11	130	130	130	3 J	27 J	26 J	0.98 J	1.5 J
COPPER	1000	4.2 J	4.45	4.7 J	25 U	3.4 J	25 U	1.4 JB	25 U
IRON	NC	91000	91000	91000	35000	39000	34000	30000 B	11000
LEAD	5	4.1 J	4.05	4 J	10 U	3.8 J	3.2 J	10 U	10 U
MAGNESIUM	NC	80000	80500	81000	18000	43000	45000	26000	8200
MANGANESE	300	98000 B	97500	97000 B	4500	78000 B	69000	4800 B	1700
NICKEL	100	80	80	80	40 U	55	52	14 J	4.5 J
POTASSIUM	NC	2100 JB	2150	2200 JB	4300 J	2200 JB	2800 J	3400 J	4500 J
SELENIUM	50	50 U	13 J	13 J	4.2 J	12 J	50 U	4.5 J	4.6 J
SILVER	100	25 U	25 U	25 U	5 U	3.6 J	25 U	5 U	5 U
SODIUM	NC	83000 B	83500	84000 B	94000	110000 B	120000	110000	51000
THALLIUM	2	26 J	28	30 J	20 U	21 J	18 J	20 U	20 U
VANADIUM	260	9.5 J	10.25	11 J	50 U	5.1 J	8.4 J	50 U	50 U
ZINC	2000	22 B	22	22 B	20 U	8.1 JB	39	20 U	20 U
<b>TOTAL METALS (UG/L)</b>									
ALUMINUM	NC	47 J	47 J	200 U	NA	60 J	NA	81 J	NA
ARSENIC	NC	50 U	50 U	50 U	NA	10 U	NA	5.2 J	NA
BARIUM	NC	61 J	60	59 J	NA	43 J	NA	66 JB	NA
BERYLLIUM	NC	4 U	4 U	4 U	NA	0.18 J	NA	4 U	NA
CALCIUM	NC	370000 B	365000	360000 B	NA	230000 B	NA	130000	NA
CHROMIUM	NC	29	29	29	NA	31	NA	5 U	NA
COBALT	NC	130	130	130	NA	28 J	NA	0.99 J	NA
COPPER	NC	3.6 J	3.85	4.1 J	NA	3.7 J	NA	1.2 JB	NA
IRON	NC	91000	90500	90000	NA	43000	NA	35000 B	NA
LEAD	NC	3.8 J	3.4	3 J	NA	5.4 J	NA	10 U	NA
MAGNESIUM	NC	81000	79500	78000	NA	45000	NA	26000	NA
MANGANESE	NC	96000 B	97500	99000 B	NA	77000 B	NA	4900 B	NA
NICKEL	NC	78	79.5	81	NA	57	NA	14 J	NA
POTASSIUM	NC	2200 JB	2150	2100 JB	NA	2300 JB	NA	3500 J	NA
SELENIUM	NC	18 J	18 J	50 U	NA	50 U	NA	5.6 J	NA
SILVER	NC	25 U	3.8 J	3.8 J	NA	25 U	NA	5 U	NA
SODIUM	NC	84000 B	83000	82000 B	NA	120000 B	NA	110000	NA
THALLIUM	NC	27 J	28.5	30 J	NA	17 J	NA	20 U	NA
VANADIUM	NC	7.6 J	9.3	11 J	NA	7.3 J	NA	50 U	NA
ZINC	NC	23 B	22.5	22 B	NA	14 JB	NA	20 U	NA

**Table 3**  
**Groundwater Analytical Results**  
**November 2015 and June 2016 Sampling Events**  
Former Lyondell Beaver Valley Site  
Potter Township, Pennsylvania

LOCATION:	PADEP Residential Used Aquifer MSC <sup>(1)</sup>	MW120	MW120	MW120	MW-120	MW159	MW-159	MW160	MW-160
SAMPLE ID:		MW120	MW120-AVG	MW120-D	MW-120	MW159	MW-159	MW160	MW-160
SAMPLE DATE:		20151109	20151109	20151109	20160620	20151110	20160621	20151111	20160620
SAMPLE CODE:		ORIG	AVG	DUP	ORIG	ORIG	ORIG	ORIG	ORIG
MATRIX:		GW	GW	GW	GW	GW	GW	GW	GW
<b>SEMIVOLATILES (UG/L)</b>									
1,1-BIPHENYL	1800	8.1 U	8.2 U	8.3 U	NA	13	NA	2 J	NA
2,4-DIMETHYLPHENOL	730	3.3 J	3.45	3.6 J	NA	2.4 J	NA	4.5 J	NA
2-METHYLNAPHTHALENE	150	1.6 U	1.65 U	1.7 U	NA	1.2 J	NA	1.7 U	NA
3&4-METHYLPHENOL	NC	3.1 J	3.2	3.3 J	NA	2.7 J	NA	2.6 J	NA
ACETOPHENONE	3700	16	16	16 J	NA	14 J	NA	19	NA
BENZALDEHYDE	NC	16 U	16.5 U	17 U	NA	3.2 J	NA	17 U	NA
BIS(2-ETHYLHEXYL)PHTHALATE	6	16 U	16.5 U	17 U	NA	16 U	NA	<b>13 J</b>	NA
DIETHYL PHTHALATE	29000	3.2 J	3.2 J	8.3 U	NA	7.6 J	NA	3 J	NA
FLUORENE	1500	1.6 U	1.65 U	1.7 U	NA	3.1	NA	0.66 J	NA
NAPHTHALENE	100	0.98 J	0.925	0.87 J	NA	26	NA	1.7 U	NA
PHENANTHRENE	1100	1.6 U	1.65 U	1.7 U	NA	5.1	NA	1.7 U	NA
PHENOL	2000	22	21	20	NA	13	NA	3.6 J	NA
<b>VOLATILES (UG/L)</b>									
BENZENE	5	<b>4100</b>	<b>4000</b>	<b>3900</b>	5 U	<b>25000</b>	<b>53000</b>	<b>770</b>	5 U
ETHYLBENZENE	700	500 U	500 U	500 U	5 U	500 U	5000 U	100 U	5 U
TOLUENE	1000	500 U	500 U	500 U	5 U	500 U	5000 U	100 U	5 U
TOTAL XYLEMES	10000	1000 U	1000 U	1000 U	10 U	1000 U	10000 U	200 U	10 U

(1) Pennsylvania Act 2 Department of Environmental Protection's Statewide Health Standard, Residential, Used Aquifer, TDS ≤ 2500 Medium -Specific Concentration (MSC)

**4100** =Exceeds MSC

ug/L = micrograms per liter

U = Below Reporting Limit

B = Detected in Method Blank

J = Estimated Result

F1 = Matrix spike recovery noncompliance

GW = Groundwater

ORIG = Original or Parent Sample

AVG = Average of Original and Duplicate Sample

DUP = Duplicate Sample

NA = Not Analyzed

NC = No Criteria

**Table 3**  
**Groundwater Analytical Results**  
**November 2015 and June 2016 Sampling Events**  
Former Lyondell Beaver Valley Site  
Potter Township, Pennsylvania

LOCATION:	PADEP Residential Used Aquifer MSC <sup>(1)</sup>	MW162	MW-162	MW163S	MW-163S	MW501S	MW-501S	MW-501S	MW-501S
SAMPLE ID:		MW162	MW-162	MW163S	MW-163S	MW501S	MW-501S	MW-501S-AVG	MW-501S-D
SAMPLE DATE:		20151109	20160620	20151110	20160621	20151111	20160621	20160621	20160621
SAMPLE CODE:		ORIG	ORIG	ORIG	ORIG	ORIG	ORIG	AVG	DUP
MATRIX:		GW	GW	GW	GW	GW	GW	GW	GW
<b>DISSOLVED METALS (UG/L)</b>									
ALUMINUM	NC	200 U	200 U	6200	20000 B	940000	850000 B	845000 B	840000 B
ARSENIC	10	10 U	10 U	10 U	20 U	50	32	29.5	27
BARIUM	2000	110 J	16 J	22 J	18 J	6.6 JB	400 U	400 U	400 U
BERYLLIUM	4	0.16 JB	4 U	1.7 J	3.6 J	43 B	40	40	40
CADMUM	5	5 U	5 U	5 U	5 U	25 U	5.8 J	5.75 J	5.7 J
CALCIUM	NC	290000	33000	120000 B	150000	390000	340000	340000	340000
CHROMIUM	100	1.6 J	5 U	40	110	380	340	340	340
COBALT	11	1.6 J	50 U	74	150	500	480	480	480
COPPER	1000	3.2 JB	25 U	25 U	220 B	200	200	200	200
IRON	NC	87000	190	210000	330000	1300000 B	1300000	1250000	1200000
LEAD	5	10 U	10 U	2.1 J	6.7 J	30 J	18 J	22.5 J	27 J
MAGNESIUM	NC	77000	25000	26000	36000	200000	180000	180000	180000
MANGANESE	300	14000 B	160	25000 B	31000	21000 B	18000	18000	18000
NICKEL	100	2.2 J	40 U	130	290	1300	1400	1350	1300
POTASSIUM	NC	4800 JB	2900 J	2100 JB	2600 J	130000	110000	110000	110000
SELENIUM	50	10 U	10 U	5.3 J	20 U	50 U	27	21.5 J	16 J
SILVER	100	5 U	5 U	5 U	10 U	25 U	10 U	10 U	10 U
SODIUM	NC	41000 B	28000	78000 B	72000	53000	50000	49500	49000
THALLIUM	2	20 U	2.7 J	7.5 J	16 J	100 U	20 U	5 J	5 J
VANADIUM	260	50 U	50 U	5.5 J	24 J	830	1000	975	950
ZINC	2000	3.5 J	20 U	19 JB	14 J	3500 B	3000	3000	3000
<b>TOTAL METALS (UG/L)</b>									
ALUMINUM	NC	130 J	NA	7600	NA	960000	NA	NA	NA
ARSENIC	NC	10 U	NA	10 U	NA	32 J	NA	NA	NA
BARIUM	NC	99 J	NA	24 J	NA	6.3 JB	NA	NA	NA
BERYLLIUM	NC	4 U	NA	1.8 J	NA	44 B	NA	NA	NA
CALCIUM	NC	270000 B	NA	120000 B	NA	400000	NA	NA	NA
CHROMIUM	NC	5.2	NA	44	NA	390	NA	NA	NA
COBALT	NC	0.91 J	NA	69	NA	510	NA	NA	NA
COPPER	NC	1.9 J	NA	25 U	NA	230 B	NA	NA	NA
IRON	NC	79000	NA	200000	NA	1300000 B	NA	NA	NA
LEAD	NC	10 U	NA	3.3 J	NA	21 J	NA	NA	NA
MAGNESIUM	NC	71000	NA	26000	NA	200000	NA	NA	NA
MANGANESE	NC	12000 B	NA	19000 B	NA	21000 B	NA	NA	NA
NICKEL	NC	1.8 J	NA	120	NA	1400	NA	NA	NA
POTASSIUM	NC	4500 JB	NA	2100 JB	NA	130000	NA	NA	NA
SELENIUM	NC	5.1 J	NA	4 J	NA	23 J	NA	NA	NA
SILVER	NC	5 U	NA	5 U	NA	25 U	NA	NA	NA
SODIUM	NC	40000 B	NA	79000 B	NA	54000	NA	NA	NA
THALLIUM	NC	2.6 J	NA	3.9 J	NA	100 U	NA	NA	NA
VANADIUM	NC	50 U	NA	6.8 J	NA	860	NA	NA	NA
ZINC	NC	4.3 JB	NA	13 JB	NA	3600 B	NA	NA	NA

**Table 3**  
**Groundwater Analytical Results**  
**November 2015 and June 2016 Sampling Events**  
Former Lyondell Beaver Valley Site  
Potter Township, Pennsylvania

LOCATION:	PADEP Residential Used Aquifer MSC <sup>(1)</sup>	MW162	MW-162	MW163S	MW-163S	MW501S	MW-501S	MW-501S	MW-501S
SAMPLE ID:		MW162	MW-162	MW163S	MW-163S	MW501S	MW-501S	MW-501S-AVG	MW-501S-D
SAMPLE DATE:		20151109	20160620	20151110	20160621	20151111	20160621	20160621	20160621
SAMPLE CODE:		ORIG	ORIG	ORIG	ORIG	ORIG	ORIG	AVG	DUP
MATRIX:		GW	GW						
<b>SEMIVOLATILES (UG/L)</b>									
1,1-BIPHENYL	1800	7.6 U	NA	8.9 U	NA	1.3 J	NA	NA	NA
2,4-DIMETHYLPHENOL	730	2.9 J	NA	8.9 U	NA	5.2 J	NA	NA	NA
2-METHYLNAPHTHALENE	150	1.5 U	NA	1.8 U	NA	1.8 U	NA	NA	NA
3&4-METHYLPHENOL	NC	7.6 U	NA	8.9 U	NA	8.9 U	NA	NA	NA
ACETOPHENONE	3700	9.5 J	NA	1.8 J	NA	610	NA	NA	NA
BENZALDEHYDE	NC	15 U	NA	18 U	NA	18 U	NA	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	6	15 U	NA	18 U	NA	6.1 J	NA	NA	NA
DIETHYL PHTHALATE	29000	4.5 J	NA	8.9 U	NA	4 J	NA	NA	NA
FLUORENE	1500	1.5 U	NA	1.8 U	NA	1.8 U	NA	NA	NA
NAPHTHALENE	100	3.7	NA	2.4	NA	20	NA	NA	NA
PHENANTHRENE	1100	1.5 U	NA	1.8 U	NA	1.8 U	NA	NA	NA
PHENOL	2000	150 F1	NA	8.9 U	NA	100	NA	NA	NA
<b>VOLATILES (UG/L)</b>									
BENZENE	5	16000	100 F1	3000	5300	95000	66000	69000	72000
ETHYLBENZENE	700	100 J	5 U	500 U	500 U	420 J	5000 U	5000 U	5000 U
TOLUENE	1000	170 J	5 U	500 U	500 U	1300	5000 U	5000 U	5000 U
TOTAL XYLEMES	10000	1000 U	10 U	1000 U	1000 U	590 J	10000 U	10000 U	10000 U

(1) Pennsylvania Act 2 Department of Environmental Protection

**4100** =Exceeds MSC

ug/L = micrograms per liter

U = Below Reporting Limit

B = Detected in Method Blank

J = Estimated Result

F1 = Matrix spike recovery noncompliance

GW = Groundwater

ORIG = Original or Parent Sample

AVG = Average of Original and Duplicate Sample

DUP = Duplicate Sample

NA = Not Analyzed

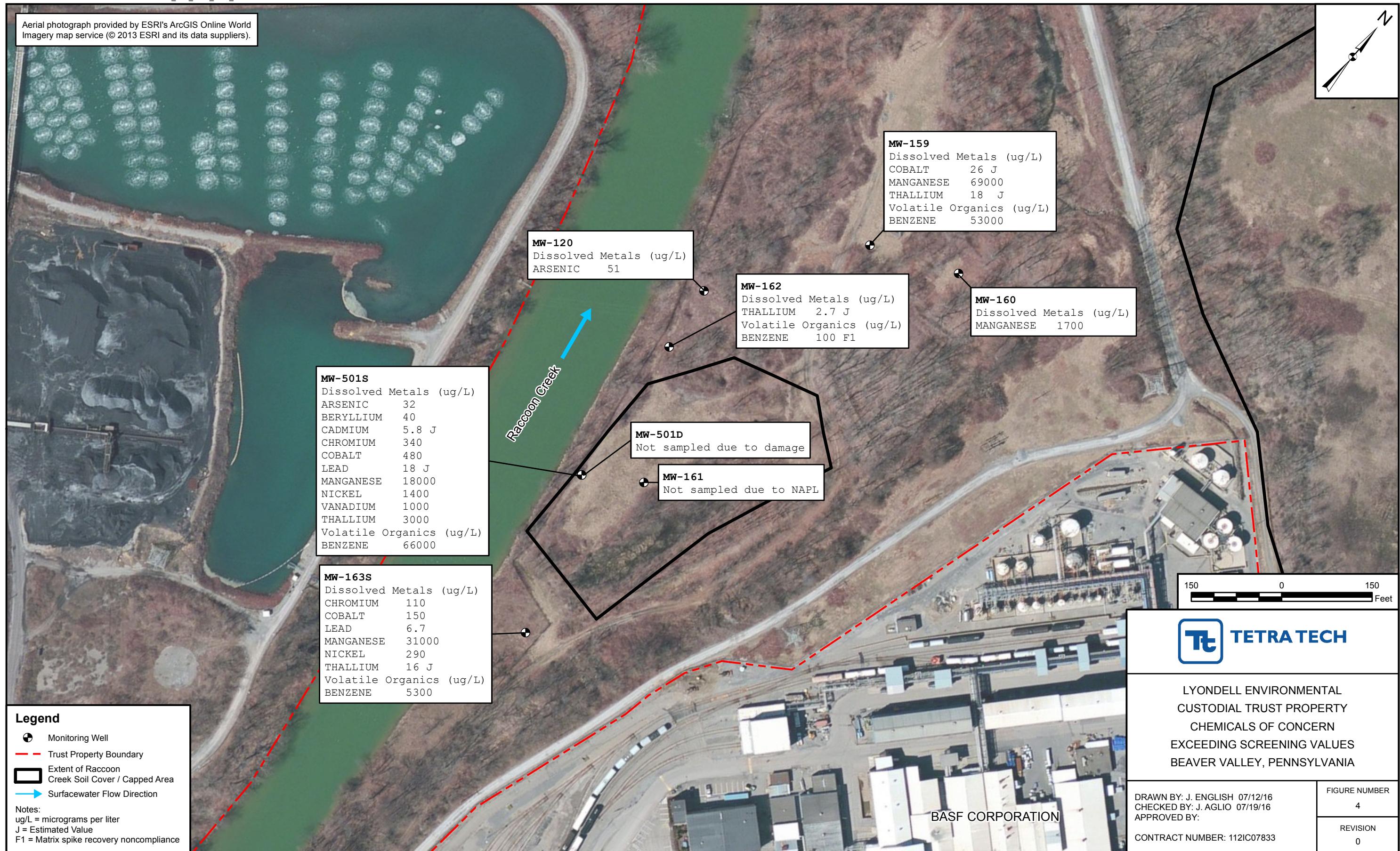
NC = No Criteria

## **FIGURES**







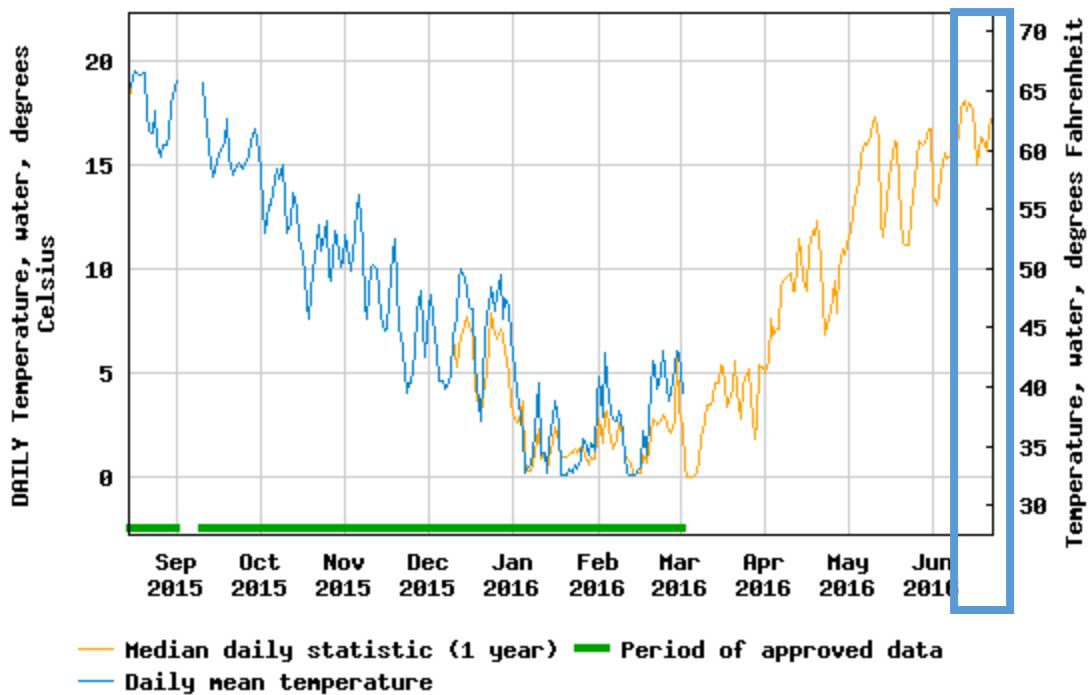




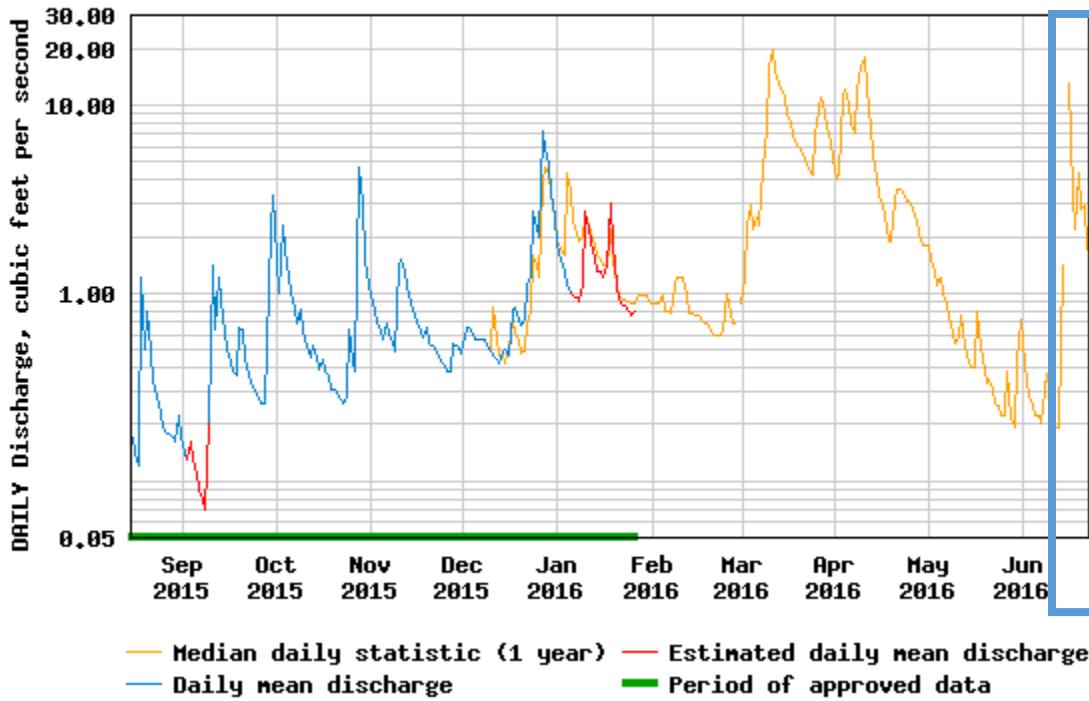
**ATTACHMENT 1**  
**USGS STAFF GAUGE SUMMARY**



### USGS 03108010 Fishpot Run near Shippingport, PA



### USGS 03108010 Fishpot Run near Shippingport, PA

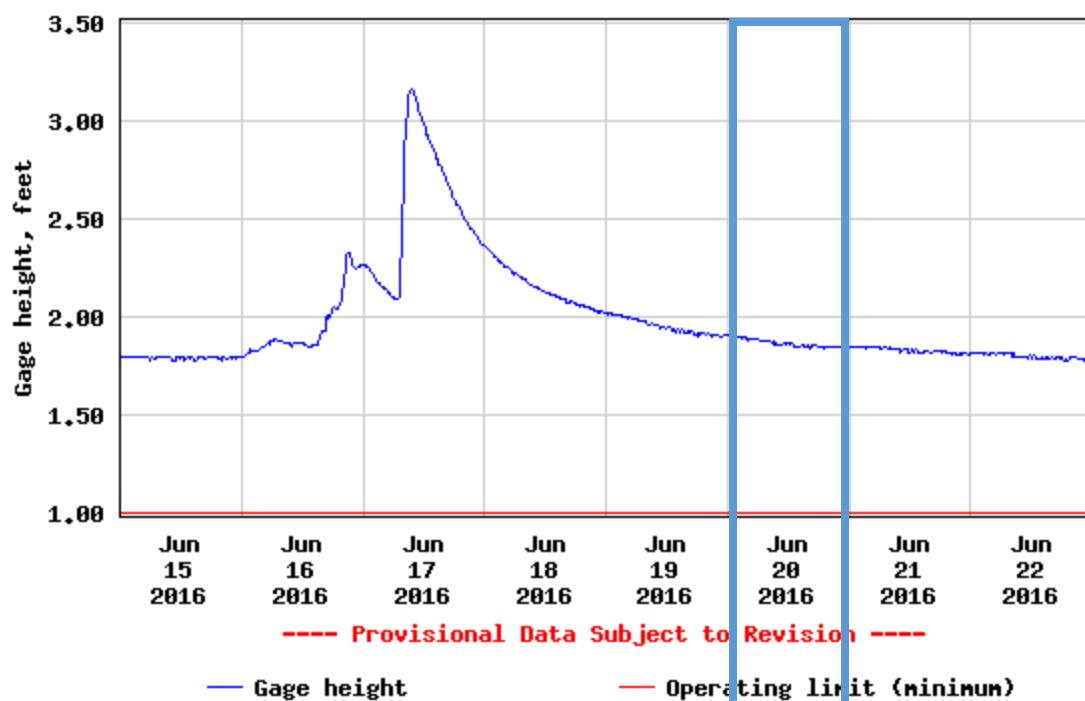


Source: USGS, [www.waterdata.usgs.gov](http://www.waterdata.usgs.gov)

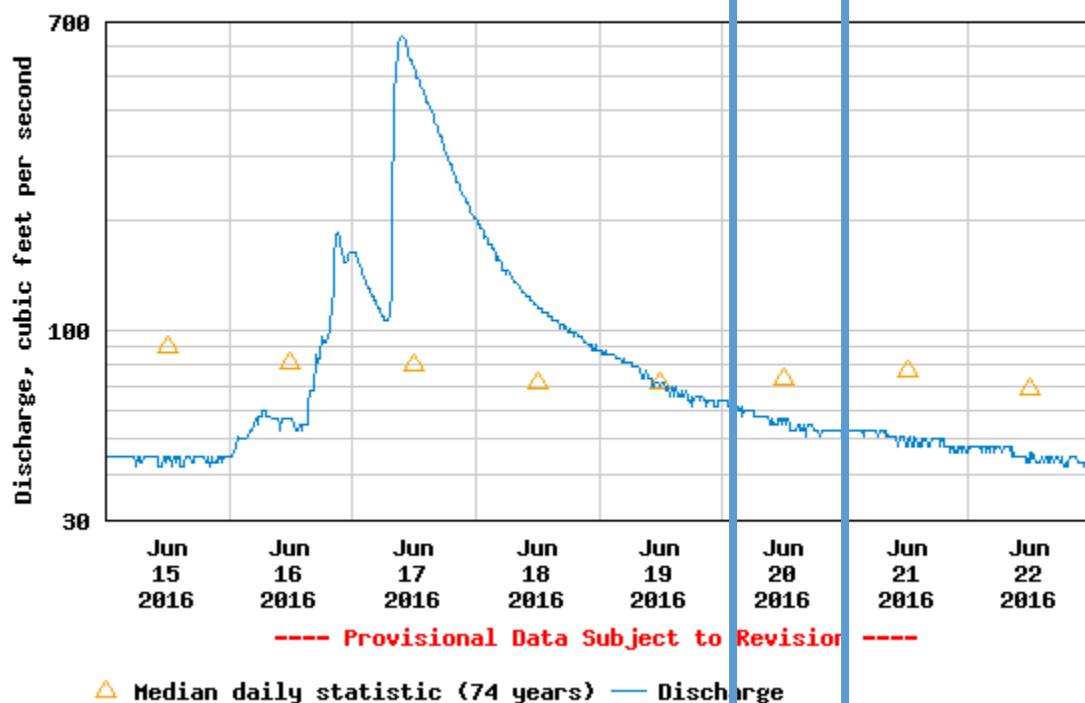
June 2016  
Water Level  
Gaging  
completed



## USGS 03108000 Raccoon Creek at Moffatts Mill, PA



## USGS 03108000 Raccoon Creek at Moffatts Mill, PA



Source: USGS, [www.waterdata.usgs.gov](http://www.waterdata.usgs.gov)

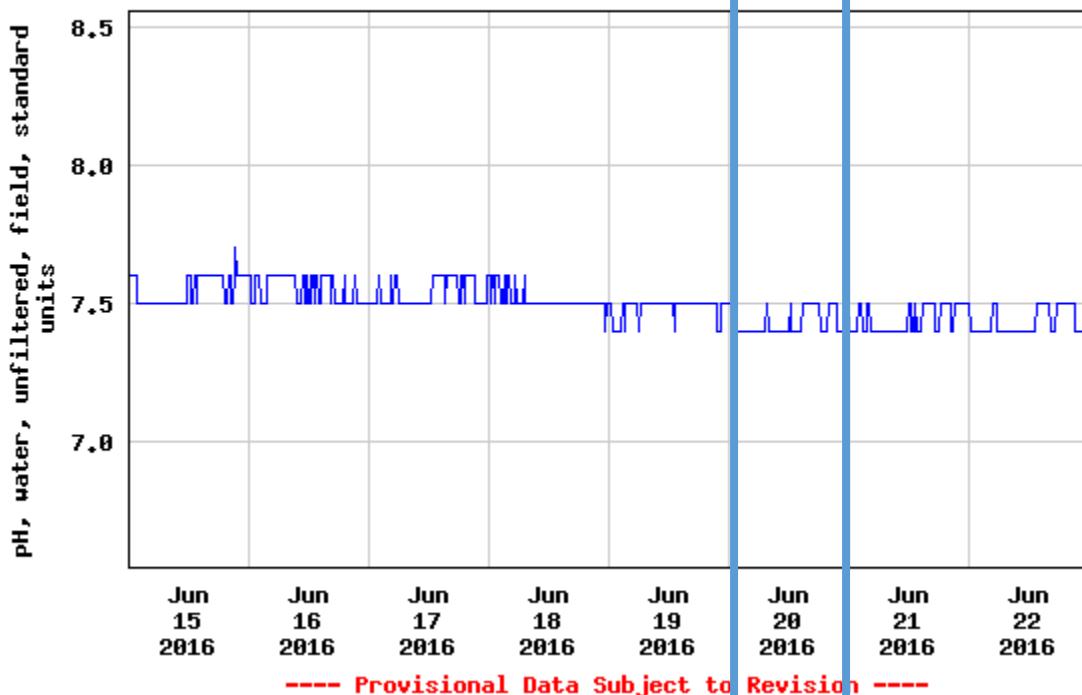
June 2016  
Water Level  
Gaging  
completed



## USGS 03108490 Ohio R ab Montgomery Dam & Locks at Ohioview, PA



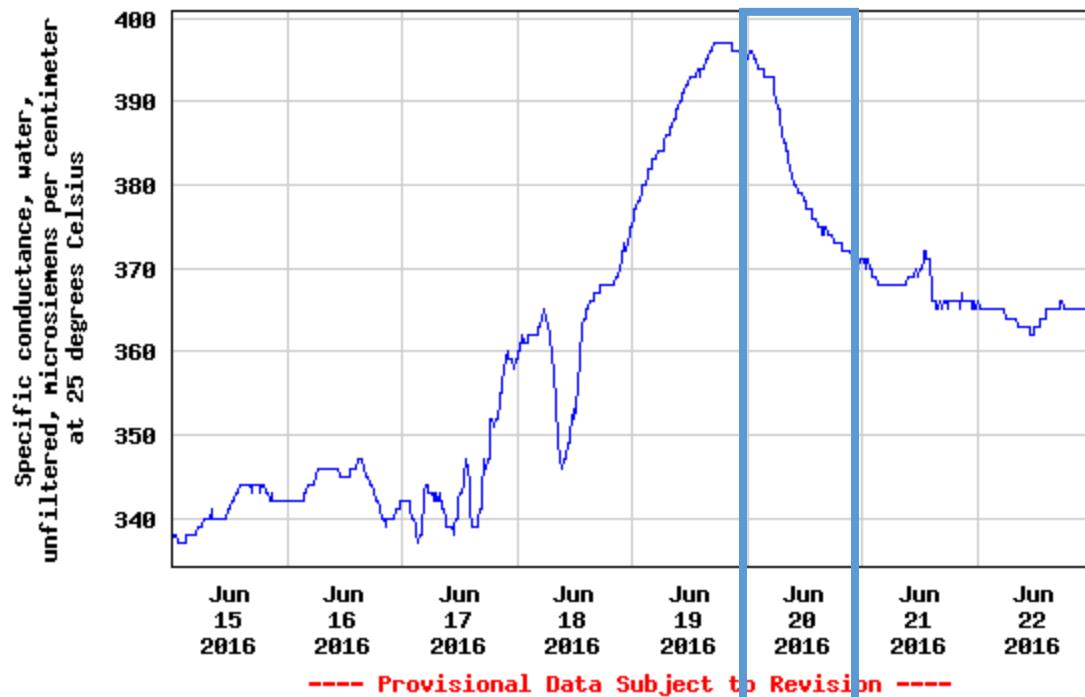
## USGS 03108490 Ohio R ab Montgomery Dam & Locks at Ohioview, PA



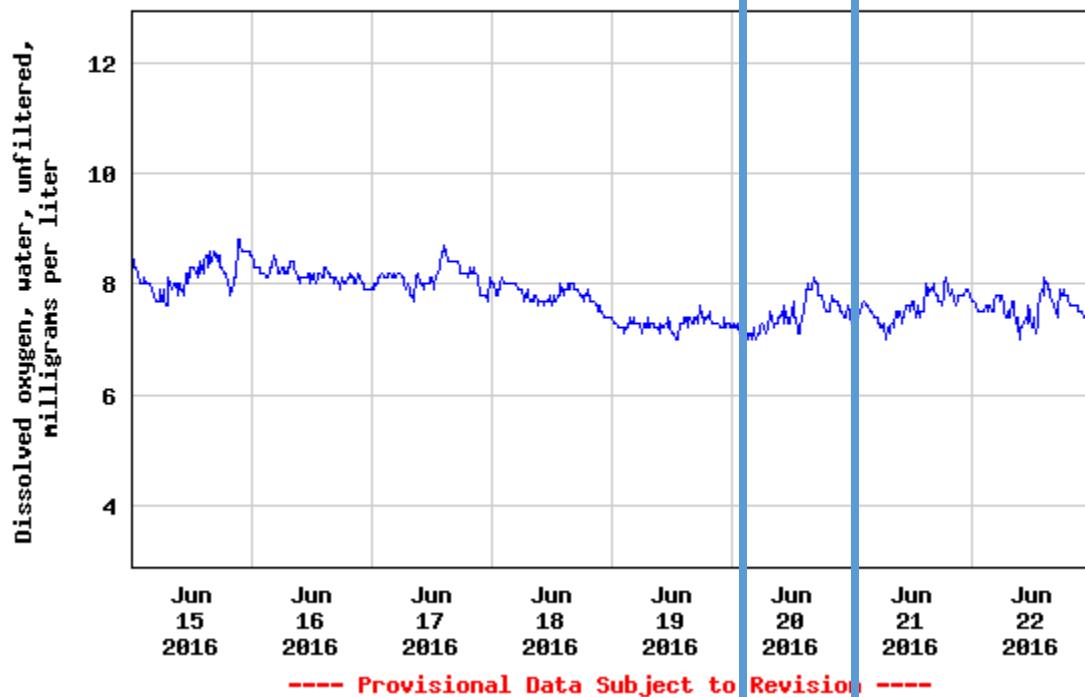
June 2016  
Water Level  
Gaging  
completed



## USGS 03108490 Ohio R ab Montgomery Dam & Locks at Ohioview, PA



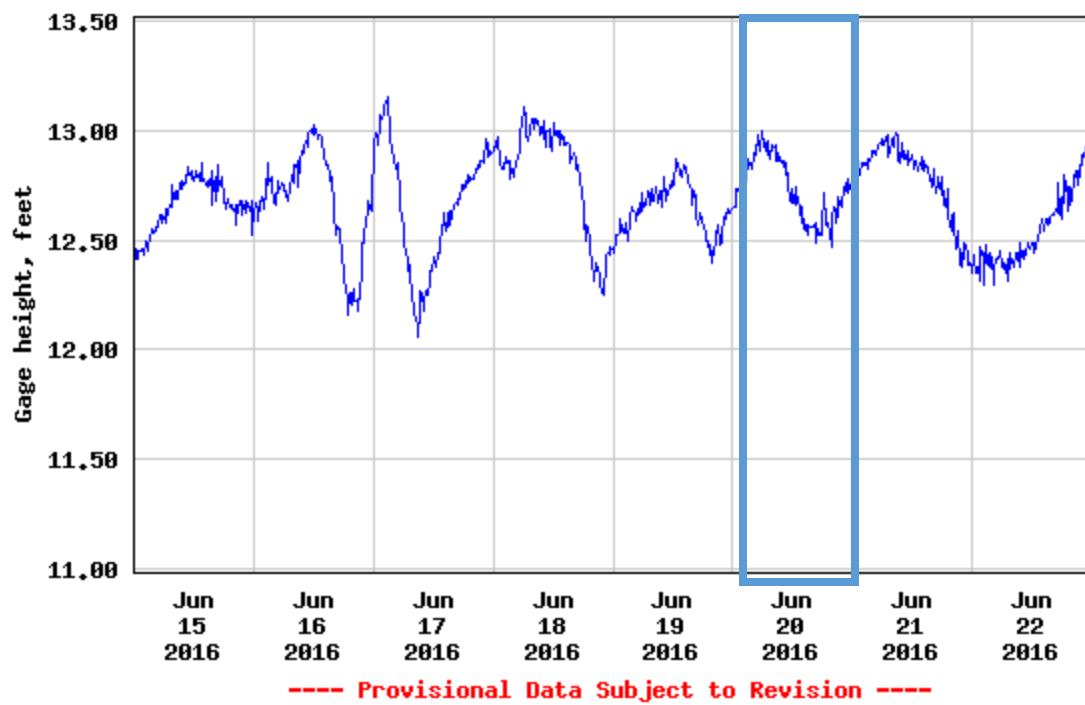
## USGS 03108490 Ohio R ab Montgomery Dam & Locks at Ohioview, PA



June 2016  
Water Level  
Gaging  
completed



## USGS 03108490 Ohio R ab Montgomery Dam & Locks at Ohiovie, PA



June 2016  
Water Level  
Gaging  
completed

**ATTACHMENT 2**  
**GROUNDWATER FIELD DATA SHEETS**



Tetra Tech

# **GROUNDWATER SAMPLE LOG SHEET**

Page \_\_\_ of \_\_\_



# LOW FLOW PURGE DATA SHEET

**PROJECT SITE NAME:**  
**PROJECT NUMBER:**

Former Lyndell Beaver Valley  
11+ICO 7833

**WELL ID.:  
DATE:**

MW-120  
6-to-16

**SIGNATURE(S):**

PAGE OF



Tetra Tech

# **GROUNDWATER SAMPLE LOG SHEET**

Page \_\_\_\_ of \_\_\_\_

Project Site Name:	Former Lyndell Beaver Valley		Sample ID No.:	MW-159	
Project No.:	112IC07833		Sample Location:	MW-159	
<input type="checkbox"/> Domestic Well Data			Sampled By:	JA	
<input checked="" type="checkbox"/> Monitoring Well Data			C.O.C. No.:		
<input type="checkbox"/> Other Well Type:			Type of Sample:		
<input type="checkbox"/> QA Sample Type:			<input type="checkbox"/> Low Concentration		
<input type="checkbox"/> High Concentration					
<b>SAMPLING DATA:</b>					
Date: 6-21-16	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)
Time: 850	Clear	5.75	2.02	14.29	15.2
Method: Bladder					5.90
				DO (mg/l)	Salinity (%)
				—	ORP —
<b>PURGE DATA:</b>					
Date: 6-21-16	Volume	pH	S.C.	Temp.	Turbidity
Method: Bladder					
Monitor Reading (ppm):					
Well Casing Diameter & Material					
Type: 4" steel					
Total Well Depth (TD): 54.07					See Attached.
Static Water Level (WL): 35.22					
One Casing Volume(gal/L):					
Start Purge (hrs): 750					
End Purge (hrs): 850					
Total Purge Time (min): 60					
Total Vol. Purged (gal/L): 21					
<b>SAMPLE COLLECTION INFORMATION:</b>					
Analysis	Preservative	Container Requirements			Collected
BTEX	HCl	3-400mL			✓
Diss metals	HNO <sub>3</sub>	1-250mL			✓
<b>OBSERVATIONS / NOTES:</b>					
<p style="text-align: center;">(Signature)</p>					
Circle if Applicable:			Signature(s):		
MS/MSD	Duplicate ID No.:				(Signature)
—	—				



# LOW FLOW PURGE DATA SHEET

**PROJECT SITE NAME:**  
**PROJECT NUMBER:**

Former Gundell Beaver Valley  
112 ICO 7833

**WELL ID.:  
DATE:**

Mv-159

$$\begin{array}{r} 10 - 8 \\ \hline 2 \end{array}$$

**SIGNATURE(S):** \_\_\_\_\_ 

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PAGE OF



Tetra Tech

## **GROUNDWATER SAMPLE LOG SHEET**

Page \_\_\_ of \_\_\_



## **LOW FLOW PURGE DATA SHEET**

**PROJECT SITE NAME:**  
**PROJECT NUMBER:**

~~Lynx~~ Beater Valley  
Beater Valley  
112 ICO 7833

**WELL ID.:  
DATE:**

MW-160  
6-20-16

**SIGNATURE(S):** \_\_\_\_\_ 

PAGE OF



Tetra Tech

## GROUNDWATER SAMPLE LOG SHEET

Page \_\_\_\_ of \_\_\_\_

Project Site Name:	<i>Yondell Beaver Valley</i>				Sample ID No.:	<i>MW-162</i>		
Project No.:	<i>(12IC07833)</i>				Sample Location:	<i>MW-162</i>		
<input type="checkbox"/> Domestic Well Data					Sampled By:			
<input checked="" type="checkbox"/> Monitoring Well Data					C.O.C. No.:			
<input type="checkbox"/> Other Well Type:					Type of Sample:			
<input type="checkbox"/> QA Sample Type:					<input type="checkbox"/> Low Concentration			
<b>SAMPLING DATA:</b>								
Date: <i>6-20-16</i>	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other <i>ORP</i>
Time: <i>1315</i>	<i>Clear</i>	<i>6.38</i>	<i>1.82</i>	<i>21.04</i>	<i>8.00</i>	<i>0.21</i>	<i>NA</i>	<i>-104</i>
Method: <i>Bladder</i>	<i>Yellow</i>			<i>12.72</i>				
<b>PURGE DATA:</b>								
Date: <i>6-20-16</i>	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: <i>Bladder</i>								
Monitor Reading (ppm): <i>—</i>								
Well Casing Diameter & Material	<i>See Attached</i>							
Type: <i>4" steel</i>								
Total Well Depth (TD): <i>41.85</i>								
Static Water Level (WL): <i>22.07</i>								
One Casing Volume(gal/L):								
Start Purge (hrs): <i>1230</i>								
End Purge (hrs): <i>1315</i>								
Total Purge Time (min): <i>45</i>								
Total Vol. Purged (gal/L):								
<b>SAMPLE COLLECTION INFORMATION:</b>								
Analysis	Preservative	Container Requirements				Collected		
<i>BTEX</i>	<i>HCl</i>	<i>3-100 mL</i>				<input checked="" type="checkbox"/>		
<i>Piss metals</i>	<i>HNO<sub>3</sub></i>	<i>1-250 mL</i>				<input checked="" type="checkbox"/>		
<b>OBSERVATIONS / NOTES:</b>								
<i>Collected ms/msd</i>								
Circle if Applicable:					Signature(s):			
<input checked="" type="checkbox"/> MS/MSD	Duplicate ID No.: <i>—</i>				<i>[Signature]</i>			



## LOW FLOW PURGE DATA SHEET

**PROJECT SITE NAME:**  
**PROJECT NUMBER:**

Fowler Lyndall Beaver Uvalax  
121CO 7833

**WELL ID.:  
DATE:**

Wen-162  
6-30-16

**SIGNATURE(S):** 

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PAGE OF



Tetra Tech

## GROUNDWATER SAMPLE LOG SHEET

Page \_\_\_\_ of \_\_\_\_

Project Site Name:	<u>Loudell Beaver Valley</u>				Sample ID No.:	<u>MW-1635</u>			
Project No.:					Sample Location:	<u>MW-1635</u>			
<input type="checkbox"/> Domestic Well Data					Sampled By:				
<input checked="" type="checkbox"/> Monitoring Well Data					C.O.C. No.:				
<input checked="" type="checkbox"/> Other Well Type:					Type of Sample:				
<input type="checkbox"/> QA Sample Type:					<input type="checkbox"/> Low Concentration				
<b>SAMPLING DATA:</b>									
Date: <u>6-21-16</u>	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other	
Time: <u>1000</u>	<u>clear</u>	<u>4.40</u>	<u>242</u>	<u>13.46</u>	<u>19.7</u>	<u>2.00</u>	<u>-</u>	<u>ERP</u>	
Method: <u>Bladder</u>									
<b>PURGE DATA:</b>									
Date: <u>6-21-16</u>	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other	
Method: <u>Bladder</u>									
Monitor Reading (ppm): <u>—</u>									
Well Casing Diameter & Material	<u>See Attached</u>								
Type: <u>4" PVC.</u>									
Total Well Depth (TD): <u>33.58</u>									
Static Water Level (WL): <u>7.18</u>									
One Casing Volume(gal/L):									
Start Purge (hrs): <u>910</u>									
End Purge (hrs): <u>1000</u>									
Total Purge Time (min): <u>50</u>									
Total Vol. Purged (gal/L):									
<b>SAMPLE COLLECTION INFORMATION:</b>									
Analysis	Preservative	Container Requirements				Collected			
<u>BTEX</u>	<u>HCl</u>	<u>3-100 mL</u>				<u>✓</u>			
<u>Diss metals</u>	<u>HNO3</u>	<u>1-250 mL</u>				<u>✓</u>			
<b>OBSERVATIONS / NOTES:</b>									
Circle if Applicable:					Signature(s):				
MS/SD	Duplicate ID No.:				<u>[Signature]</u>				
<u>—</u>	<u>—</u>								



## LOW FLOW PURGE DATA SHEET

**PROJECT SITE NAME:**  
**PROJECT NUMBER:**

Former Lyndell Beaver Valley  
112IC07833

**WELL ID.:**  
**DATE:**

MW-~~16~~ 35  
6-11-16

**SIGNATURE(S):**

PAGE \_\_\_\_ OF \_\_\_\_



Tetra Tech

## GROUNDWATER SAMPLE LOG SHEET

Page \_\_\_\_ of \_\_\_\_

Project Site Name:	<u>Lyondell Beaver Valley</u>				Sample ID No.:	<u>MW-501S</u>				
Project No.:					Sample Location:	<u>MW-501S</u>				
<input type="checkbox"/> Domestic Well Data					Sampled By:					
<input checked="" type="checkbox"/> Monitoring Well Data					C.O.C. No.:					
<input type="checkbox"/> Other Well Type:					Type of Sample:					
<input type="checkbox"/> QA Sample Type:					<input type="checkbox"/> Low Concentration					
								<input type="checkbox"/> High Concentration		
<b>SAMPLING DATA:</b>										
Date: <u>MW-501S</u>	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other		
Time: <u>1130</u>		<u>2.69</u>	<u>8.55</u>	<u>15.00</u>	<u>29.5</u>	<u>0.58</u>	<u>-</u>	<u>ORP</u>		
Method: <u>Peri</u>	<u>Clear/Yellow</u>					<u>2.16</u>				
<b>PURGE DATA:</b>										
Date: <u>MW-501S</u>	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other		
Method: <u>Peri</u>										
Monitor Reading (ppm): <u>-</u>										
Well Casing Diameter & Material										
Type: <u>3" PVC</u>										
Total Well Depth (TD): <u>42.56</u>										
Static Water Level (WL): <u>17.45</u>										
One Casing Volume(gal/L): <u>4</u>										
Start Purge (hrs): <u>1040</u>										
End Purge (hrs): <u>1130</u>										
Total Purge Time (min): <u>50</u>										
Total Vol. Purged (gal): <u>20</u>										
<b>SAMPLE COLLECTION INFORMATION:</b>										
Analysis	Preservative	Container Requirements				Collected				
<u>BTEX</u>	<u>HCl</u>	<u>3-500 ml</u>				<u>✓</u>				
<u>Diss metals</u>	<u>HNO<sub>3</sub></u>	<u>1-250 mL plastic</u>				<u>✓</u>				
<b>OBSERVATIONS / NOTES:</b>										
<p style="text-align: center;">(Large yellow smudge here)</p>										
Circle if Applicable:					Signature(s):					
MS/MSD	Duplicate ID No.:					<u>JH</u>				
<u>-</u>	<u>DUP-01</u>									



## LOW FLOW PURGE DATA SHEET

**PROJECT SITE NAME:**  
**PROJECT NUMBER:**

Lyndon B. Beaver Valley  
11-ECO7833

**WELL ID.:  
DATE:**

MW-5015  
8-31-16

**SIGNATURE(S):** \_\_\_\_\_

PAGE OF

**ATTACHMENT 3**  
**TESTAMERICA ANALYTICAL REPORT**

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica Pittsburgh  
301 Alpha Drive  
RIDC Park  
Pittsburgh, PA 15238  
Tel: (412)963-7058

TestAmerica Job ID: 180-55922-1

Client Project/Site: Lyondell Beaver Valley Plant Groundwater

For:

Tetra Tech, Inc.  
Foster Plaza 7  
661 Anderson Drive  
Pittsburgh, Pennsylvania 15220-2745

Attn: Mr. Jonathon Aglio



Authorized for release by:

6/29/2016 10:24:05 AM

Jill Colussy, Project Manager I  
(412)963-2444  
[jill.colussy@testamericainc.com](mailto:jill.colussy@testamericainc.com)

### LINKS

Review your project  
results through

TotalAccess

Have a Question?

Ask  
The  
Expert

Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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# Case Narrative

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Job ID: 180-55922-1

### Laboratory: TestAmerica Pittsburgh

#### Narrative

#### Job Narrative 180-55922-1

#### Receipt

The samples were received on 6/22/2016 3:30 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.4° C.

All of the VOA vials for samples FB-01 (180-55922-2), MW-159 (180-55922-5), MW-501S (180-55922-7) and DUP-01 (180-55922-8) were received with headspace.

#### GC/MS VOA

The following samples were diluted to bring the concentration of target analytes within the calibration range: MW-159 (180-55922-5), MW-163S (180-55922-6), MW-501S (180-55922-7) and DUP-01 (180-55922-8). Elevated reporting limits (RLs) are provided

The matrix spike duplicate of sample MW-160 (180-55922-1) had surrogate dibromofluoromethane recover outside of the control limits.. The parent sample and the matrix spike had all surrogates recoveries were within limits. All data was reported "as is".

#### Metals

The following samples were diluted to bring the concentration of manganese within the linear range of the instrument: MW-159 (180-55922-5) and MW-163S (180-55922-6). Elevated reporting limits (RLs) are provided. Silver, selenium, and thallium were also reported from dilution due to interelement corrections associated with manganese. Arsenic was reported from dilution due to the concentration being less than the negative reporting limit.

Due to sample matrix effect on the internal standard (ISTD), a dilution was required for the following samples: MW-501S (180-55922-7) and DUP-01 (180-55922-8). All analytes referencing the yttrium internal standards required dilution due to the yttrium counts being high and outside the 70%-130% control limits.

The following samples were diluted to bring the concentration of iron within the linear range of the instrument: MW-501S (180-55922-7) and DUP-01 (180-55922-8). Elevated reporting limits (RLs) are provided. Nickel, lead, antimony, and vanadium were also reported from dilution due to interelement corrections associated with iron.

# Definitions/Glossary

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Qualifiers

### GC/MS VOA

Qualifier	Qualifier Description
X	Surrogate is outside control limits
F1	MS and/or MSD Recovery is outside acceptance limits.

### Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F1	MS and/or MSD Recovery is outside acceptance limits.
B	Compound was found in the blank and sample.

## Glossary

### Abbreviation

These commonly used abbreviations may or may not be present in this report.

□	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

# Certification Summary

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Laboratory: TestAmerica Pittsburgh

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Pennsylvania	NELAP	3	02-00416	04-30-17

1

2

3

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9

10

11

12

13

## Sample Summary

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
180-55922-1	MW-160	Water	06/20/16 10:15	06/22/16 15:30
180-55922-2	FB-01	Water	06/20/16 11:30	06/22/16 15:30
180-55922-3	MW-120	Water	06/20/16 12:00	06/22/16 15:30
180-55922-4	MW-162	Water	06/20/16 13:15	06/22/16 15:30
180-55922-5	MW-159	Water	06/21/16 08:50	06/22/16 15:30
180-55922-6	MW-163S	Water	06/21/16 10:00	06/22/16 15:30
180-55922-7	MW-501S	Water	06/21/16 11:30	06/22/16 15:30
180-55922-8	DUP-01	Water	06/21/16 00:00	06/22/16 15:30
180-55922-9	TRIP BLANK	Water	06/21/16 00:00	06/22/16 15:30

# Method Summary

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

Method	Method Description	Protocol	Laboratory
8260C	Volatile Organic Compounds by GC/MS	SW846	TAL PIT
6010C	Metals (ICP)	SW846	TAL PIT
7470A	Mercury (CVAA)	SW846	TAL PIT

## Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

## Laboratory References:

TAL PIT = TestAmerica Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

# Lab Chronicle

Client: Tetra Tech, Inc.

TestAmerica Job ID: 180-55922-1

Project/Site: Lyondell Beaver Valley Plant Groundwater

**Client Sample ID: MW-160**

**Date Collected: 06/20/16 10:15**

**Date Received: 06/22/16 15:30**

**Lab Sample ID: 180-55922-1**

**Matrix: Water**

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	5 mL	5 mL	180105	06/24/16 07:59	KLG	TAL PIT
		Instrument ID: CHHP9								
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		1	50 mL	50 mL	180321	06/27/16 07:47	RJG	TAL PIT
		Instrument ID: C								
Dissolved	Prep	7470A			50 mL	50 mL	179990	06/23/16 08:18	EVR	TAL PIT
Dissolved	Analysis	7470A		1	50 mL	50 mL	180201	06/24/16 11:00	EVR	TAL PIT
		Instrument ID: K								

**Client Sample ID: FB-01**

**Date Collected: 06/20/16 11:30**

**Date Received: 06/22/16 15:30**

**Lab Sample ID: 180-55922-2**

**Matrix: Water**

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	5 mL	5 mL	180008	06/23/16 16:45	PJJ	TAL PIT
		Instrument ID: CHHP4								
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		1	50 mL	50 mL	180321	06/27/16 07:52	RJG	TAL PIT
		Instrument ID: C								
Dissolved	Prep	7470A			50 mL	50 mL	179990	06/23/16 08:18	EVR	TAL PIT
Dissolved	Analysis	7470A		1	50 mL	50 mL	180201	06/24/16 11:02	EVR	TAL PIT
		Instrument ID: K								

**Client Sample ID: MW-120**

**Date Collected: 06/20/16 12:00**

**Date Received: 06/22/16 15:30**

**Lab Sample ID: 180-55922-3**

**Matrix: Water**

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	5 mL	5 mL	180008	06/23/16 18:01	PJJ	TAL PIT
		Instrument ID: CHHP4								
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		1	50 mL	50 mL	180321	06/27/16 07:57	RJG	TAL PIT
		Instrument ID: C								
Dissolved	Prep	7470A			50 mL	50 mL	179990	06/23/16 08:18	EVR	TAL PIT
Dissolved	Analysis	7470A		1	50 mL	50 mL	180201	06/24/16 11:04	EVR	TAL PIT
		Instrument ID: K								

**Client Sample ID: MW-162**

**Date Collected: 06/20/16 13:15**

**Date Received: 06/22/16 15:30**

**Lab Sample ID: 180-55922-4**

**Matrix: Water**

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	5 mL	5 mL	180008	06/23/16 14:14	PJJ	TAL PIT

TestAmerica Pittsburgh

# Lab Chronicle

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Client Sample ID: MW-162

Date Collected: 06/20/16 13:15

Date Received: 06/22/16 15:30

## Lab Sample ID: 180-55922-4

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	5 mL	5 mL	180008	06/23/16 14:14	PJJ	TAL PIT
		Instrument ID: CHHP4								
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		1	50 mL	50 mL	180321	06/27/16 08:02	RJG	TAL PIT
		Instrument ID: C								
Dissolved	Prep	7470A			50 mL	50 mL	179990	06/23/16 08:18	EVR	TAL PIT
Dissolved	Analysis	7470A		1	50 mL	50 mL	180201	06/24/16 11:06	EVR	TAL PIT
		Instrument ID: K								

## Client Sample ID: MW-159

Date Collected: 06/21/16 08:50

Date Received: 06/22/16 15:30

## Lab Sample ID: 180-55922-5

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1000	5 mL	5 mL	180105	06/24/16 10:56	KLG	TAL PIT
		Instrument ID: CHHP9								
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		1	50 mL	50 mL	180321	06/27/16 08:32	RJG	TAL PIT
		Instrument ID: C								
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		5	50 mL	50 mL	180321	06/27/16 08:53	RJG	TAL PIT
		Instrument ID: C								
Dissolved	Prep	7470A			50 mL	50 mL	179990	06/23/16 08:18	EVR	TAL PIT
Dissolved	Analysis	7470A		1	50 mL	50 mL	180201	06/24/16 11:16	EVR	TAL PIT
		Instrument ID: K								

## Client Sample ID: MW-163S

Date Collected: 06/21/16 10:00

Date Received: 06/22/16 15:30

## Lab Sample ID: 180-55922-6

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		100	5 mL	5 mL	180105	06/24/16 09:29	KLG	TAL PIT
		Instrument ID: CHHP9								
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		1	50 mL	50 mL	180321	06/27/16 08:37	RJG	TAL PIT
		Instrument ID: C								
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		2	50 mL	50 mL	180321	06/27/16 08:58	RJG	TAL PIT
		Instrument ID: C								
Dissolved	Prep	7470A			50 mL	50 mL	179990	06/23/16 08:18	EVR	TAL PIT
Dissolved	Analysis	7470A		1	50 mL	50 mL	180201	06/24/16 11:18	EVR	TAL PIT
		Instrument ID: K								

TestAmerica Pittsburgh

# Lab Chronicle

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Client Sample ID: MW-501S

Date Collected: 06/21/16 11:30

Date Received: 06/22/16 15:30

## Lab Sample ID: 180-55922-7

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1000	5 mL	5 mL	180105	06/24/16 10:13	KLG	TAL PIT
Instrument ID: CHHP9										
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		1	50 mL	50 mL	180321	06/27/16 08:43	RJG	TAL PIT
Instrument ID: C										
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		2	50 mL	50 mL	180321	06/27/16 09:03	RJG	TAL PIT
Instrument ID: C										
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		5	50 mL	50 mL	180321	06/27/16 09:29	RJG	TAL PIT
Instrument ID: C										
Dissolved	Prep	7470A			50 mL	50 mL	179990	06/23/16 08:18	EVR	TAL PIT
Dissolved	Analysis	7470A		1	50 mL	50 mL	180201	06/24/16 11:20	EVR	TAL PIT
Instrument ID: K										

## Client Sample ID: DUP-01

Date Collected: 06/21/16 00:00

Date Received: 06/22/16 15:30

## Lab Sample ID: 180-55922-8

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1000	5 mL	5 mL	180105	06/24/16 10:35	KLG	TAL PIT
Instrument ID: CHHP9										
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		1	50 mL	50 mL	180321	06/27/16 08:48	RJG	TAL PIT
Instrument ID: C										
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		2	50 mL	50 mL	180321	06/27/16 09:09	RJG	TAL PIT
Instrument ID: C										
Dissolved	Prep	3005A			50 mL	50 mL	179974	06/23/16 07:16	ANA	TAL PIT
Dissolved	Analysis	6010C		5	50 mL	50 mL	180321	06/27/16 09:34	RJG	TAL PIT
Instrument ID: C										
Dissolved	Prep	7470A			50 mL	50 mL	179990	06/23/16 08:18	EVR	TAL PIT
Dissolved	Analysis	7470A		1	50 mL	50 mL	180201	06/24/16 11:22	EVR	TAL PIT
Instrument ID: K										

## Client Sample ID: TRIP BLANK

Date Collected: 06/21/16 00:00

Date Received: 06/22/16 15:30

## Lab Sample ID: 180-55922-9

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	5 mL	5 mL	180008	06/23/16 16:20	PJJ	TAL PIT
Instrument ID: CHHP4										

TestAmerica Pittsburgh

## Lab Chronicle

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

### Laboratory References:

TAL PIT = TestAmerica Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

### Analyst References:

Lab: TAL PIT

Batch Type: Prep

ANA = Alexis Anderson

EVR = Emilie Reichenbach

Batch Type: Analysis

EVR = Emilie Reichenbach

KLG = Kathy Gordon

PJJ = Patrick Journet

RJG = Rob Good

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# Client Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

**Client Sample ID: MW-160**

Date Collected: 06/20/16 10:15

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-1**

Matrix: Water

## Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		5.0	3.0	ug/L			06/24/16 07:59	1
Toluene	ND		5.0	3.6	ug/L			06/24/16 07:59	1
Ethylbenzene	ND		5.0	2.0	ug/L			06/24/16 07:59	1
Xylenes, Total	ND		10	4.6	ug/L			06/24/16 07:59	1
m-Xylene & p-Xylene	ND		5.0	1.9	ug/L			06/24/16 07:59	1
o-Xylene	ND		5.0	2.9	ug/L			06/24/16 07:59	1
<b>Surrogate</b>		<b>%Recovery</b>	<b>Qualifier</b>	<b>Limits</b>			<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
1,2-Dichloroethane-d4 (Surr)	94			62 - 123				06/24/16 07:59	1
4-Bromofluorobenzene (Surr)	92			75 - 120				06/24/16 07:59	1
Dibromofluoromethane (Surr)	96			80 - 120				06/24/16 07:59	1
Toluene-d8 (Surr)	98			80 - 120				06/24/16 07:59	1

## Method: 6010C - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		5.0	1.2	ug/L			06/23/16 07:16	06/27/16 07:47
Aluminum	ND		200	37	ug/L			06/23/16 07:16	06/27/16 07:47
Arsenic	ND		10	4.8	ug/L			06/23/16 07:16	06/27/16 07:47
Antimony	ND		10	3.2	ug/L			06/23/16 07:16	06/27/16 07:47
<b>Barium</b>	<b>52 J</b>		200	3.2	ug/L			06/23/16 07:16	06/27/16 07:47
Beryllium	ND		4.0	0.42	ug/L			06/23/16 07:16	06/27/16 07:47
Cadmium	ND		5.0	0.20	ug/L			06/23/16 07:16	06/27/16 07:47
<b>Calcium</b>	<b>69000</b>		5000	89	ug/L			06/23/16 07:16	06/27/16 07:47
Chromium	ND		5.0	0.61	ug/L			06/23/16 07:16	06/27/16 07:47
<b>Cobalt</b>	<b>1.5 J</b>		50	0.51	ug/L			06/23/16 07:16	06/27/16 07:47
Copper	ND		25	3.4	ug/L			06/23/16 07:16	06/27/16 07:47
<b>Iron</b>	<b>11000</b>		100	41	ug/L			06/23/16 07:16	06/27/16 07:47
Lead	ND		10	3.1	ug/L			06/23/16 07:16	06/27/16 07:47
<b>Magnesium</b>	<b>8200</b>		5000	79	ug/L			06/23/16 07:16	06/27/16 07:47
<b>Manganese</b>	<b>1700</b>		15	1.1	ug/L			06/23/16 07:16	06/27/16 07:47
<b>Nickel</b>	<b>4.5 J</b>		40	3.2	ug/L			06/23/16 07:16	06/27/16 07:47
<b>Potassium</b>	<b>4500 J</b>		5000	620	ug/L			06/23/16 07:16	06/27/16 07:47
<b>Selenium</b>	<b>4.6 J</b>		10	3.8	ug/L			06/23/16 07:16	06/27/16 07:47
<b>Sodium</b>	<b>51000</b>		5000	190	ug/L			06/23/16 07:16	06/27/16 07:47
Thallium	ND		20	2.6	ug/L			06/23/16 07:16	06/27/16 07:47
Vanadium	ND		50	6.9	ug/L			06/23/16 07:16	06/27/16 07:47
Zinc	ND		20	6.9	ug/L			06/23/16 07:16	06/27/16 07:47

## Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.052	ug/L			06/23/16 08:18	06/24/16 11:00

**Client Sample ID: FB-01**

Date Collected: 06/20/16 11:30

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-2**

Matrix: Water

## Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		5.0	3.0	ug/L			06/23/16 16:45	1
Toluene	ND		5.0	3.6	ug/L			06/23/16 16:45	1

TestAmerica Pittsburgh

# Client Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

**Client Sample ID: FB-01**

Date Collected: 06/20/16 11:30

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-2**

Matrix: Water

## Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethylbenzene	ND		5.0	2.0	ug/L			06/23/16 16:45	1
Xylenes, Total	ND		10	4.6	ug/L			06/23/16 16:45	1
m-Xylene & p-Xylene	ND		5.0	1.9	ug/L			06/23/16 16:45	1
o-Xylene	ND		5.0	2.9	ug/L			06/23/16 16:45	1
<b>Surrogate</b>	<b>%Recovery</b>	<b>Qualifier</b>	<b>Limits</b>				<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
1,2-Dichloroethane-d4 (Surr)	86		62 - 123					06/23/16 16:45	1
4-Bromofluorobenzene (Surr)	91		75 - 120					06/23/16 16:45	1
Dibromofluoromethane (Surr)	98		80 - 120					06/23/16 16:45	1
Toluene-d8 (Surr)	89		80 - 120					06/23/16 16:45	1

## Method: 6010C - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		5.0	1.2	ug/L		06/23/16 07:16	06/27/16 07:52	1
Aluminum	ND		200	37	ug/L		06/23/16 07:16	06/27/16 07:52	1
Arsenic	ND		10	4.8	ug/L		06/23/16 07:16	06/27/16 07:52	1
Antimony	ND		10	3.2	ug/L		06/23/16 07:16	06/27/16 07:52	1
Barium	ND		200	3.2	ug/L		06/23/16 07:16	06/27/16 07:52	1
Beryllium	ND		4.0	0.42	ug/L		06/23/16 07:16	06/27/16 07:52	1
Cadmium	ND		5.0	0.20	ug/L		06/23/16 07:16	06/27/16 07:52	1
Calcium	ND		5000	89	ug/L		06/23/16 07:16	06/27/16 07:52	1
Chromium	ND		5.0	0.61	ug/L		06/23/16 07:16	06/27/16 07:52	1
Cobalt	ND		50	0.51	ug/L		06/23/16 07:16	06/27/16 07:52	1
Copper	ND		25	3.4	ug/L		06/23/16 07:16	06/27/16 07:52	1
<b>Iron</b>	<b>110</b>		100	41	ug/L		06/23/16 07:16	06/27/16 07:52	1
Lead	ND		10	3.1	ug/L		06/23/16 07:16	06/27/16 07:52	1
Magnesium	ND		5000	79	ug/L		06/23/16 07:16	06/27/16 07:52	1
Manganese	ND		15	1.1	ug/L		06/23/16 07:16	06/27/16 07:52	1
Nickel	ND		40	3.2	ug/L		06/23/16 07:16	06/27/16 07:52	1
Potassium	ND		5000	620	ug/L		06/23/16 07:16	06/27/16 07:52	1
Selenium	ND		10	3.8	ug/L		06/23/16 07:16	06/27/16 07:52	1
<b>Sodium</b>	<b>940 J</b>		5000	190	ug/L		06/23/16 07:16	06/27/16 07:52	1
Thallium	ND		20	2.6	ug/L		06/23/16 07:16	06/27/16 07:52	1
Vanadium	ND		50	6.9	ug/L		06/23/16 07:16	06/27/16 07:52	1
Zinc	ND		20	6.9	ug/L		06/23/16 07:16	06/27/16 07:52	1

## Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.052	ug/L		06/23/16 08:18	06/24/16 11:02	1

**Client Sample ID: MW-120**

Date Collected: 06/20/16 12:00

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-3**

Matrix: Water

## Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		5.0	3.0	ug/L			06/23/16 18:01	1
Toluene	ND		5.0	3.6	ug/L			06/23/16 18:01	1
Ethylbenzene	ND		5.0	2.0	ug/L			06/23/16 18:01	1
Xylenes, Total	ND		10	4.6	ug/L			06/23/16 18:01	1

TestAmerica Pittsburgh

# Client Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

**Client Sample ID: MW-120**

Date Collected: 06/20/16 12:00

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-3**

Matrix: Water

## Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
m-Xylene & p-Xylene	ND		5.0	1.9	ug/L			06/23/16 18:01	1
o-Xylene	ND		5.0	2.9	ug/L			06/23/16 18:01	1
<b>Surrogate</b>									
1,2-Dichloroethane-d4 (Surr)	80		62 - 123				Prepared	06/23/16 18:01	1
4-Bromofluorobenzene (Surr)	88		75 - 120					06/23/16 18:01	1
Dibromofluoromethane (Surr)	92		80 - 120					06/23/16 18:01	1
Toluene-d8 (Surr)	91		80 - 120					06/23/16 18:01	1

## Method: 6010C - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		5.0	1.2	ug/L			06/23/16 07:16	06/27/16 07:57
Aluminum	ND		200	37	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Arsenic</b>	<b>51</b>		10	4.8	ug/L			06/23/16 07:16	06/27/16 07:57
Antimony	ND		10	3.2	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Barium</b>	<b>160 J</b>		200	3.2	ug/L			06/23/16 07:16	06/27/16 07:57
Beryllium	ND		4.0	0.42	ug/L			06/23/16 07:16	06/27/16 07:57
Cadmium	ND		5.0	0.20	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Calcium</b>	<b>110000</b>		5000	89	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Chromium</b>	<b>2.8 J</b>		5.0	0.61	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Cobalt</b>	<b>3.0 J</b>		50	0.51	ug/L			06/23/16 07:16	06/27/16 07:57
Copper	ND		25	3.4	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Iron</b>	<b>35000</b>		100	41	ug/L			06/23/16 07:16	06/27/16 07:57
Lead	ND		10	3.1	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Magnesium</b>	<b>18000</b>		5000	79	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Manganese</b>	<b>4500</b>		15	1.1	ug/L			06/23/16 07:16	06/27/16 07:57
Nickel	ND		40	3.2	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Potassium</b>	<b>4300 J</b>		5000	620	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Selenium</b>	<b>4.2 J</b>		10	3.8	ug/L			06/23/16 07:16	06/27/16 07:57
<b>Sodium</b>	<b>94000</b>		5000	190	ug/L			06/23/16 07:16	06/27/16 07:57
Thallium	ND		20	2.6	ug/L			06/23/16 07:16	06/27/16 07:57
Vanadium	ND		50	6.9	ug/L			06/23/16 07:16	06/27/16 07:57
Zinc	ND		20	6.9	ug/L			06/23/16 07:16	06/27/16 07:57

## Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.052	ug/L			06/23/16 08:18	06/24/16 11:04

**Client Sample ID: MW-162**

Date Collected: 06/20/16 13:15

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-4**

Matrix: Water

## Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
<b>Benzene</b>	<b>100 F1</b>		5.0	3.0	ug/L			06/23/16 14:14	1
Toluene	ND		5.0	3.6	ug/L			06/23/16 14:14	1
Ethylbenzene	ND		5.0	2.0	ug/L			06/23/16 14:14	1
Xylenes, Total	ND		10	4.6	ug/L			06/23/16 14:14	1
m-Xylene & p-Xylene	ND		5.0	1.9	ug/L			06/23/16 14:14	1
o-Xylene	ND		5.0	2.9	ug/L			06/23/16 14:14	1

TestAmerica Pittsburgh

# Client Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

**Client Sample ID: MW-162**

Date Collected: 06/20/16 13:15

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-4**

Matrix: Water

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	70		62 - 123		06/23/16 14:14	1
4-Bromofluorobenzene (Surr)	91		75 - 120		06/23/16 14:14	1
Dibromofluoromethane (Surr)	90		80 - 120		06/23/16 14:14	1
Toluene-d8 (Surr)	87		80 - 120		06/23/16 14:14	1

## Method: 6010C - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		5.0	1.2	ug/L		06/23/16 07:16	06/27/16 08:02	1
Aluminum	ND		200	37	ug/L		06/23/16 07:16	06/27/16 08:02	1
Arsenic	ND		10	4.8	ug/L		06/23/16 07:16	06/27/16 08:02	1
Antimony	ND		10	3.2	ug/L		06/23/16 07:16	06/27/16 08:02	1
<b>Barium</b>	<b>16 J</b>		200	3.2	ug/L		06/23/16 07:16	06/27/16 08:02	1
Beryllium	ND		4.0	0.42	ug/L		06/23/16 07:16	06/27/16 08:02	1
Cadmium	ND		5.0	0.20	ug/L		06/23/16 07:16	06/27/16 08:02	1
<b>Calcium</b>	<b>33000</b>		5000	89	ug/L		06/23/16 07:16	06/27/16 08:02	1
Chromium	ND		5.0	0.61	ug/L		06/23/16 07:16	06/27/16 08:02	1
Cobalt	ND		50	0.51	ug/L		06/23/16 07:16	06/27/16 08:02	1
Copper	ND		25	3.4	ug/L		06/23/16 07:16	06/27/16 08:02	1
<b>Iron</b>	<b>190</b>		100	41	ug/L		06/23/16 07:16	06/27/16 08:02	1
Lead	ND		10	3.1	ug/L		06/23/16 07:16	06/27/16 08:02	1
<b>Magnesium</b>	<b>25000</b>		5000	79	ug/L		06/23/16 07:16	06/27/16 08:02	1
<b>Manganese</b>	<b>160</b>		15	1.1	ug/L		06/23/16 07:16	06/27/16 08:02	1
Nickel	ND		40	3.2	ug/L		06/23/16 07:16	06/27/16 08:02	1
<b>Potassium</b>	<b>2900 J</b>		5000	620	ug/L		06/23/16 07:16	06/27/16 08:02	1
Selenium	ND		10	3.8	ug/L		06/23/16 07:16	06/27/16 08:02	1
<b>Sodium</b>	<b>28000</b>		5000	190	ug/L		06/23/16 07:16	06/27/16 08:02	1
<b>Thallium</b>	<b>2.7 J</b>		20	2.6	ug/L		06/23/16 07:16	06/27/16 08:02	1
Vanadium	ND		50	6.9	ug/L		06/23/16 07:16	06/27/16 08:02	1
Zinc	ND		20	6.9	ug/L		06/23/16 07:16	06/27/16 08:02	1

## Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND	F1	0.20	0.052	ug/L		06/23/16 08:18	06/24/16 11:06	1

**Client Sample ID: MW-159**

Date Collected: 06/21/16 08:50

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-5**

Matrix: Water

## Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
<b>Benzene</b>	<b>53000</b>		5000	3000	ug/L			06/24/16 10:56	1000
Toluene	ND		5000	3600	ug/L			06/24/16 10:56	1000
Ethylbenzene	ND		5000	2000	ug/L			06/24/16 10:56	1000
Xylenes, Total	ND		10000	4600	ug/L			06/24/16 10:56	1000
m-Xylene & p-Xylene	ND		5000	1900	ug/L			06/24/16 10:56	1000
o-Xylene	ND		5000	2900	ug/L			06/24/16 10:56	1000
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	106		62 - 123					06/24/16 10:56	1000
4-Bromofluorobenzene (Surr)	99		75 - 120					06/24/16 10:56	1000
Dibromofluoromethane (Surr)	107		80 - 120					06/24/16 10:56	1000

TestAmerica Pittsburgh

# Client Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

**Client Sample ID: MW-159**

Date Collected: 06/21/16 08:50

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-5**

Matrix: Water

## Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Surrogate	%Recovery	Qualifier	Limits		Prepared	Analyzed	Dil Fac
	103		80 - 120	80 - 120			

## Method: 6010C - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		25	5.8	ug/L	06/23/16 07:16	06/27/16 08:53	5	
<b>Aluminum</b>	<b>49</b>	<b>J B</b>	200	37	ug/L	06/23/16 07:16	06/27/16 08:32	1	
Arsenic	ND		50	24	ug/L	06/23/16 07:16	06/27/16 08:53	5	
Antimony	ND		10	3.2	ug/L	06/23/16 07:16	06/27/16 08:32	1	
<b>Barium</b>	<b>38</b>	<b>J</b>	200	3.2	ug/L	06/23/16 07:16	06/27/16 08:32	1	
Beryllium	ND		4.0	0.42	ug/L	06/23/16 07:16	06/27/16 08:32	1	
<b>Cadmium</b>	<b>0.32</b>	<b>J</b>	5.0	0.20	ug/L	06/23/16 07:16	06/27/16 08:32	1	
<b>Calcium</b>	<b>240000</b>		5000	89	ug/L	06/23/16 07:16	06/27/16 08:32	1	
<b>Chromium</b>	<b>19</b>		5.0	0.61	ug/L	06/23/16 07:16	06/27/16 08:32	1	
<b>Cobalt</b>	<b>26</b>	<b>J</b>	50	0.51	ug/L	06/23/16 07:16	06/27/16 08:32	1	
Copper	ND		25	3.4	ug/L	06/23/16 07:16	06/27/16 08:32	1	
<b>Iron</b>	<b>34000</b>		100	41	ug/L	06/23/16 07:16	06/27/16 08:32	1	
<b>Lead</b>	<b>3.2</b>	<b>J</b>	10	3.1	ug/L	06/23/16 07:16	06/27/16 08:32	1	
Magnesium	45000		5000	79	ug/L	06/23/16 07:16	06/27/16 08:32	1	
Manganese	69000		75	5.7	ug/L	06/23/16 07:16	06/27/16 08:53	5	
Nickel	52		40	3.2	ug/L	06/23/16 07:16	06/27/16 08:32	1	
Potassium	2800	J	5000	620	ug/L	06/23/16 07:16	06/27/16 08:32	1	
Selenium	ND		50	19	ug/L	06/23/16 07:16	06/27/16 08:53	5	
<b>Sodium</b>	<b>120000</b>		5000	190	ug/L	06/23/16 07:16	06/27/16 08:32	1	
Thallium	18	J	100	13	ug/L	06/23/16 07:16	06/27/16 08:53	5	
Vanadium	8.4	J	50	6.9	ug/L	06/23/16 07:16	06/27/16 08:32	1	
Zinc	39		20	6.9	ug/L	06/23/16 07:16	06/27/16 08:32	1	

## Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.052	ug/L	06/23/16 08:18	06/24/16 11:16	1	

**Client Sample ID: MW-163S**

Date Collected: 06/21/16 10:00

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-6**

Matrix: Water

## Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
<b>Benzene</b>	<b>5300</b>		500	300	ug/L			06/24/16 09:29	100
Toluene	ND		500	360	ug/L			06/24/16 09:29	100
Ethylbenzene	ND		500	200	ug/L			06/24/16 09:29	100
Xylenes, Total	ND		1000	460	ug/L			06/24/16 09:29	100
m-Xylene & p-Xylene	ND		500	190	ug/L			06/24/16 09:29	100
o-Xylene	ND		500	290	ug/L			06/24/16 09:29	100
Surrogate	%Recovery	Qualifier	Limits			D	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	106		62 - 123				06/24/16 09:29	100	
4-Bromofluorobenzene (Surr)	100		75 - 120				06/24/16 09:29	100	
Dibromofluoromethane (Surr)	96		80 - 120				06/24/16 09:29	100	
Toluene-d8 (Surr)	105		80 - 120				06/24/16 09:29	100	

TestAmerica Pittsburgh

# Client Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

**Client Sample ID: MW-163S**

Date Collected: 06/21/16 10:00

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-6**

Matrix: Water

**Method: 6010C - Metals (ICP) - Dissolved**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		10	2.3	ug/L		06/23/16 07:16	06/27/16 08:58	2
<b>Aluminum</b>	<b>20000</b>	<b>B</b>	200	37	ug/L		06/23/16 07:16	06/27/16 08:37	1
Arsenic	ND		20	9.7	ug/L		06/23/16 07:16	06/27/16 08:58	2
Antimony	ND		10	3.2	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Barium</b>	<b>18</b>	<b>J</b>	200	3.2	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Beryllium</b>	<b>3.6</b>	<b>J</b>	4.0	0.42	ug/L		06/23/16 07:16	06/27/16 08:37	1
Cadmium	ND		5.0	0.20	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Calcium</b>	<b>150000</b>		5000	89	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Chromium</b>	<b>110</b>		5.0	0.61	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Cobalt</b>	<b>150</b>		50	0.51	ug/L		06/23/16 07:16	06/27/16 08:37	1
Copper	ND		25	3.4	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Iron</b>	<b>330000</b>		100	41	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Lead</b>	<b>6.7</b>	<b>J</b>	10	3.1	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Magnesium</b>	<b>36000</b>		5000	79	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Manganese</b>	<b>31000</b>		30	2.3	ug/L		06/23/16 07:16	06/27/16 08:58	2
<b>Nickel</b>	<b>290</b>		40	3.2	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Potassium</b>	<b>2600</b>	<b>J</b>	5000	620	ug/L		06/23/16 07:16	06/27/16 08:37	1
Selenium	ND		20	7.5	ug/L		06/23/16 07:16	06/27/16 08:58	2
<b>Sodium</b>	<b>72000</b>		5000	190	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Thallium</b>	<b>16</b>	<b>J</b>	40	5.3	ug/L		06/23/16 07:16	06/27/16 08:58	2
<b>Vanadium</b>	<b>24</b>	<b>J</b>	50	6.9	ug/L		06/23/16 07:16	06/27/16 08:37	1
<b>Zinc</b>	<b>14</b>	<b>J</b>	20	6.9	ug/L		06/23/16 07:16	06/27/16 08:37	1

**Method: 7470A - Mercury (CVAA) - Dissolved**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
<b>Mercury</b>	<b>0.057</b>	<b>J</b>	0.20	0.052	ug/L		06/23/16 08:18	06/24/16 11:18	1

**Client Sample ID: MW-501S**

Date Collected: 06/21/16 11:30

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-7**

Matrix: Water

**Method: 8260C - Volatile Organic Compounds by GC/MS**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
<b>Benzene</b>	<b>66000</b>		5000	3000	ug/L			06/24/16 10:13	1000
Toluene	ND		5000	3600	ug/L			06/24/16 10:13	1000
Ethylbenzene	ND		5000	2000	ug/L			06/24/16 10:13	1000
Xylenes, Total	ND		10000	4600	ug/L			06/24/16 10:13	1000
m-Xylene & p-Xylene	ND		5000	1900	ug/L			06/24/16 10:13	1000
o-Xylene	ND		5000	2900	ug/L			06/24/16 10:13	1000
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	108		62 - 123					06/24/16 10:13	1000
4-Bromofluorobenzene (Surr)	99		75 - 120					06/24/16 10:13	1000
Dibromofluoromethane (Surr)	102		80 - 120					06/24/16 10:13	1000
Toluene-d8 (Surr)	103		80 - 120					06/24/16 10:13	1000

**Method: 6010C - Metals (ICP) - Dissolved**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		10	2.3	ug/L		06/23/16 07:16	06/27/16 09:03	2
<b>Aluminum</b>	<b>850000</b>	<b>B</b>	400	74	ug/L		06/23/16 07:16	06/27/16 09:03	2

TestAmerica Pittsburgh

# Client Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

**Client Sample ID: MW-501S**

Date Collected: 06/21/16 11:30

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-7**

Matrix: Water

**Method: 6010C - Metals (ICP) - Dissolved (Continued)**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	32		20	9.7	ug/L		06/23/16 07:16	06/27/16 09:03	2
Antimony	ND		50	16	ug/L		06/23/16 07:16	06/27/16 09:29	5
Barium	ND		400	6.5	ug/L		06/23/16 07:16	06/27/16 09:03	2
Beryllium	40		8.0	0.85	ug/L		06/23/16 07:16	06/27/16 09:03	2
Cadmium	5.8 J		10	0.39	ug/L		06/23/16 07:16	06/27/16 09:03	2
Calcium	340000		10000	180	ug/L		06/23/16 07:16	06/27/16 09:03	2
Chromium	340		10	1.2	ug/L		06/23/16 07:16	06/27/16 09:03	2
Cobalt	480		50	0.51	ug/L		06/23/16 07:16	06/27/16 08:43	1
Copper	200		50	6.7	ug/L		06/23/16 07:16	06/27/16 09:03	2
Iron	1300000		500	200	ug/L		06/23/16 07:16	06/27/16 09:29	5
Lead	18 J		50	15	ug/L		06/23/16 07:16	06/27/16 09:29	5
Magnesium	180000		10000	160	ug/L		06/23/16 07:16	06/27/16 09:03	2
Manganese	18000		30	2.3	ug/L		06/23/16 07:16	06/27/16 09:03	2
Nickel	1400		200	16	ug/L		06/23/16 07:16	06/27/16 09:29	5
Potassium	110000		10000	1200	ug/L		06/23/16 07:16	06/27/16 09:03	2
Selenium	27		20	7.5	ug/L		06/23/16 07:16	06/27/16 09:03	2
Sodium	50000		10000	370	ug/L		06/23/16 07:16	06/27/16 09:03	2
Thallium	ND		20	2.6	ug/L		06/23/16 07:16	06/27/16 08:43	1
Vanadium	1000		250	34	ug/L		06/23/16 07:16	06/27/16 09:29	5
Zinc	3000		40	14	ug/L		06/23/16 07:16	06/27/16 09:03	2

**Method: 7470A - Mercury (CVAA) - Dissolved**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.070 J		0.20	0.052	ug/L		06/23/16 08:18	06/24/16 11:20	1

**Client Sample ID: DUP-01**

Date Collected: 06/21/16 00:00

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-8**

Matrix: Water

**Method: 8260C - Volatile Organic Compounds by GC/MS**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	72000		5000	3000	ug/L		06/24/16 10:35		1000
Toluene	ND		5000	3600	ug/L		06/24/16 10:35		1000
Ethylbenzene	ND		5000	2000	ug/L		06/24/16 10:35		1000
Xylenes, Total	ND		10000	4600	ug/L		06/24/16 10:35		1000
m-Xylene & p-Xylene	ND		5000	1900	ug/L		06/24/16 10:35		1000
o-Xylene	ND		5000	2900	ug/L		06/24/16 10:35		1000
<b>Surrogate</b>	<b>%Recovery</b>	<b>Qualifier</b>	<b>Limits</b>				<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
1,2-Dichloroethane-d4 (Surr)	107		62 - 123				06/24/16 10:35		1000
4-Bromofluorobenzene (Surr)	97		75 - 120				06/24/16 10:35		1000
Dibromofluoromethane (Surr)	88		80 - 120				06/24/16 10:35		1000
Toluene-d8 (Surr)	101		80 - 120				06/24/16 10:35		1000

**Method: 6010C - Metals (ICP) - Dissolved**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		10	2.3	ug/L		06/23/16 07:16	06/27/16 09:09	2
Aluminum	840000 B		400	74	ug/L		06/23/16 07:16	06/27/16 09:09	2
Arsenic	27		20	9.7	ug/L		06/23/16 07:16	06/27/16 09:09	2
Antimony	ND		50	16	ug/L		06/23/16 07:16	06/27/16 09:34	5

TestAmerica Pittsburgh

# Client Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

**Client Sample ID: DUP-01**

Date Collected: 06/21/16 00:00

Date Received: 06/22/16 15:30

**Lab Sample ID: 180-55922-8**

Matrix: Water

**Method: 6010C - Metals (ICP) - Dissolved (Continued)**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Barium	ND		400	6.5	ug/L		06/23/16 07:16	06/27/16 09:09	2
Beryllium	40		8.0	0.85	ug/L		06/23/16 07:16	06/27/16 09:09	2
Cadmium	5.7 J		10	0.39	ug/L		06/23/16 07:16	06/27/16 09:09	2
Calcium	340000		10000	180	ug/L		06/23/16 07:16	06/27/16 09:09	2
Chromium	340		10	1.2	ug/L		06/23/16 07:16	06/27/16 09:09	2
Cobalt	480		50	0.51	ug/L		06/23/16 07:16	06/27/16 08:48	1
Copper	200		50	6.7	ug/L		06/23/16 07:16	06/27/16 09:09	2
Iron	1200000		500	200	ug/L		06/23/16 07:16	06/27/16 09:34	5
Lead	27 J		50	15	ug/L		06/23/16 07:16	06/27/16 09:34	5
Magnesium	180000		10000	160	ug/L		06/23/16 07:16	06/27/16 09:09	2
Manganese	18000		30	2.3	ug/L		06/23/16 07:16	06/27/16 09:09	2
Nickel	1300		200	16	ug/L		06/23/16 07:16	06/27/16 09:34	5
Potassium	110000		10000	1200	ug/L		06/23/16 07:16	06/27/16 09:09	2
Selenium	16 J		20	7.5	ug/L		06/23/16 07:16	06/27/16 09:09	2
Sodium	49000		10000	370	ug/L		06/23/16 07:16	06/27/16 09:09	2
Thallium	5.0 J		20	2.6	ug/L		06/23/16 07:16	06/27/16 08:48	1
Vanadium	950		250	34	ug/L		06/23/16 07:16	06/27/16 09:34	5
Zinc	3000		40	14	ug/L		06/23/16 07:16	06/27/16 09:09	2

**Method: 7470A - Mercury (CVAA) - Dissolved**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.052	ug/L		06/23/16 08:18	06/24/16 11:22	1

**Client Sample ID: TRIP BLANK**

**Lab Sample ID: 180-55922-9**

Matrix: Water

Date Collected: 06/21/16 00:00

Date Received: 06/22/16 15:30

**Method: 8260C - Volatile Organic Compounds by GC/MS**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		5.0	3.0	ug/L		06/23/16 16:20		1
Toluene	ND		5.0	3.6	ug/L		06/23/16 16:20		1
Ethylbenzene	ND		5.0	2.0	ug/L		06/23/16 16:20		1
Xylenes, Total	ND		10	4.6	ug/L		06/23/16 16:20		1
m-Xylene & p-Xylene	ND		5.0	1.9	ug/L		06/23/16 16:20		1
o-Xylene	ND		5.0	2.9	ug/L		06/23/16 16:20		1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	89		62 - 123				06/23/16 16:20		1
4-Bromofluorobenzene (Surr)	97		75 - 120				06/23/16 16:20		1
Dibromofluoromethane (Surr)	105		80 - 120				06/23/16 16:20		1
Toluene-d8 (Surr)	95		80 - 120				06/23/16 16:20		1

TestAmerica Pittsburgh

# QC Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Method: 8260C - Volatile Organic Compounds by GC/MS

**Lab Sample ID: MB 180-180008/7**

**Matrix: Water**

**Analysis Batch: 180008**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**

Analyte	MB	MB	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
	Result	Qualifier							
Benzene	ND		5.0	3.0	ug/L			06/23/16 11:11	1
Toluene	ND		5.0	3.6	ug/L			06/23/16 11:11	1
Ethylbenzene	ND		5.0	2.0	ug/L			06/23/16 11:11	1
Xylenes, Total	ND		10	4.6	ug/L			06/23/16 11:11	1
m-Xylene & p-Xylene	ND		5.0	1.9	ug/L			06/23/16 11:11	1
o-Xylene	ND		5.0	2.9	ug/L			06/23/16 11:11	1

Surrogate	MB	MB	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
	Result	Qualifier						
1,2-Dichloroethane-d4 (Surr)	94		62 - 123				06/23/16 11:11	1
4-Bromofluorobenzene (Surr)	94		75 - 120				06/23/16 11:11	1
Dibromofluoromethane (Surr)	102		80 - 120				06/23/16 11:11	1
Toluene-d8 (Surr)	93		80 - 120				06/23/16 11:11	1

**Lab Sample ID: LCS 180-180008/14**

**Matrix: Water**

**Analysis Batch: 180008**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**

Analyte	Spike	LCS	LCS	Result	Qualifier	Unit	D	%Rec	%Rec.
	Added	Result	Qualifier						
Benzene	40.0	40.2		ug/L			101	80 - 120	
Toluene	40.0	39.8		ug/L			99	80 - 124	
Ethylbenzene	40.0	40.9		ug/L			102	79 - 124	
Xylenes, Total	80.0	80.9		ug/L			101	81 - 121	
m-Xylene & p-Xylene	40.0	41.6		ug/L			104	78 - 124	
o-Xylene	40.0	39.3		ug/L			98	78 - 124	

Surrogate	LCS	LCS	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
	Result	Qualifier						
1,2-Dichloroethane-d4 (Surr)	80		62 - 123					
4-Bromofluorobenzene (Surr)	92		75 - 120					
Dibromofluoromethane (Surr)	93		80 - 120					
Toluene-d8 (Surr)	81		80 - 120					

**Lab Sample ID: 180-55922-4 MS**

**Matrix: Water**

**Analysis Batch: 180008**

**Client Sample ID: MW-162**  
**Prep Type: Total/NA**

Analyte	Sample	Sample	Spike	MS	MS	Result	Qualifier	Unit	D	%Rec	%Rec.
	Result	Qualifier	Added	Result	Qualifier						
Benzene	100	F1	40.0	109	F1	ug/L			12	80 - 120	
Toluene	ND		40.0	35.3		ug/L			88	80 - 124	
Ethylbenzene	ND		40.0	36.9		ug/L			92	79 - 124	
Xylenes, Total	ND		80.0	71.6		ug/L			90	81 - 121	
m-Xylene & p-Xylene	ND		40.0	36.9		ug/L			92	78 - 124	
o-Xylene	ND		40.0	34.7		ug/L			87	78 - 124	

Surrogate	MS	MS	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
	Result	Qualifier						
1,2-Dichloroethane-d4 (Surr)	79		62 - 123					
4-Bromofluorobenzene (Surr)	94		75 - 120					
Dibromofluoromethane (Surr)	98		80 - 120					

TestAmerica Pittsburgh

# QC Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

**Lab Sample ID: 180-55922-4 MS**

**Matrix: Water**

**Analysis Batch: 180008**

**Client Sample ID: MW-162**

**Prep Type: Total/NA**

Surrogate	MS %Recovery	MS Qualifier	MS Limits
Toluene-d8 (Surr)	84		80 - 120

**Lab Sample ID: 180-55922-4 MSD**

**Matrix: Water**

**Analysis Batch: 180008**

**Client Sample ID: MW-162**

**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec. Limits	RPD	RPD Limit
Benzene	100	F1	40.0	113	F1	ug/L	23	80 - 120	4	20
Toluene	ND		40.0	35.1		ug/L	88	80 - 124	1	20
Ethylbenzene	ND		40.0	36.7		ug/L	92	79 - 124	0	25
Xylenes, Total	ND		80.0	70.6		ug/L	88	81 - 121	1	20
m-Xylene & p-Xylene	ND		40.0	36.4		ug/L	91	78 - 124	2	24
o-Xylene	ND		40.0	34.2		ug/L	85	78 - 124	2	22

Surrogate	MSD %Recovery	MSD Qualifier	MSD Limits
1,2-Dichloroethane-d4 (Surr)	73		62 - 123
4-Bromofluorobenzene (Surr)	92		75 - 120
Dibromofluoromethane (Surr)	93		80 - 120
Toluene-d8 (Surr)	83		80 - 120

**Lab Sample ID: MB 180-180105/6**

**Matrix: Water**

**Analysis Batch: 180105**

**Client Sample ID: Method Blank**

**Prep Type: Total/NA**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		5.0	3.0	ug/L			06/24/16 07:24	1
Toluene	ND		5.0	3.6	ug/L			06/24/16 07:24	1
Ethylbenzene	ND		5.0	2.0	ug/L			06/24/16 07:24	1
Xylenes, Total	ND		10	4.6	ug/L			06/24/16 07:24	1
m-Xylene & p-Xylene	ND		5.0	1.9	ug/L			06/24/16 07:24	1
o-Xylene	ND		5.0	2.9	ug/L			06/24/16 07:24	1

Surrogate	MB %Recovery	MB Qualifier	MB Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	99		62 - 123			1
4-Bromofluorobenzene (Surr)	98		75 - 120			1
Dibromofluoromethane (Surr)	100		80 - 120			1
Toluene-d8 (Surr)	103		80 - 120			1

**Lab Sample ID: LCS 180-180105/3**

**Matrix: Water**

**Analysis Batch: 180105**

**Client Sample ID: Lab Control Sample**

**Prep Type: Total/NA**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec. Limits
Benzene	40.0	40.3		ug/L	101	80 - 120
Toluene	40.0	43.1		ug/L	108	80 - 124
Ethylbenzene	40.0	41.8		ug/L	104	79 - 124
Xylenes, Total	80.0	86.2		ug/L	108	81 - 121

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# QC Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

**Lab Sample ID: LCS 180-180105/3**

**Matrix: Water**

**Analysis Batch: 180105**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**

Analyte		Spike	LCS	LCS	Unit	D	%Rec	%Rec.
		Added	Result	Qualifier				
m-Xylene & p-Xylene		40.0	43.6		ug/L		109	78 - 124
o-Xylene		40.0	42.6		ug/L		107	78 - 124
<b>Surrogate</b>								
1,2-Dichloroethane-d4 (Surr)	97		62 - 123					
4-Bromofluorobenzene (Surr)	107		75 - 120					
Dibromofluoromethane (Surr)	109		80 - 120					
Toluene-d8 (Surr)	106		80 - 120					

**Lab Sample ID: 180-55922-1 MS**

**Matrix: Water**

**Analysis Batch: 180105**

**Client Sample ID: MW-160**  
**Prep Type: Total/NA**

Analyte	Sample	Sample	Spike	MS	MS	Unit	D	%Rec	%Rec.
	Result	Qualifier	Added	Result	Qualifier				
Benzene	ND		40.0	40.0		ug/L		100	80 - 120
Toluene	ND		40.0	44.1		ug/L		110	80 - 124
Ethylbenzene	ND		40.0	42.7		ug/L		107	79 - 124
Xylenes, Total	ND		80.0	85.8		ug/L		107	81 - 121
m-Xylene & p-Xylene	ND		40.0	43.4		ug/L		109	78 - 124
o-Xylene	ND		40.0	42.4		ug/L		106	78 - 124
<b>Surrogate</b>									
1,2-Dichloroethane-d4 (Surr)	93		62 - 123						
4-Bromofluorobenzene (Surr)	104		75 - 120						
Dibromofluoromethane (Surr)	97		80 - 120						
Toluene-d8 (Surr)	104		80 - 120						

**Lab Sample ID: 180-55922-1 MSD**

**Matrix: Water**

**Analysis Batch: 180105**

**Client Sample ID: MW-160**  
**Prep Type: Total/NA**

Analyte	Sample	Sample	Spike	MSD	MSD	Unit	D	%Rec	%Rec.
	Result	Qualifier	Added	Result	Qualifier				
Benzene	ND		40.0	41.6		ug/L		104	80 - 120
Toluene	ND		40.0	46.5		ug/L		116	80 - 124
Ethylbenzene	ND		40.0	45.8		ug/L		115	79 - 124
Xylenes, Total	ND		80.0	90.6		ug/L		113	81 - 121
m-Xylene & p-Xylene	ND		40.0	45.7		ug/L		114	78 - 124
o-Xylene	ND		40.0	44.9		ug/L		112	78 - 124
<b>Surrogate</b>									
1,2-Dichloroethane-d4 (Surr)	96		62 - 123						
4-Bromofluorobenzene (Surr)	106		75 - 120						
Dibromofluoromethane (Surr)	72	X	80 - 120						
Toluene-d8 (Surr)	106		80 - 120						

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# QC Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Method: 6010C - Metals (ICP)

**Lab Sample ID: MB 180-179974/1-A**

**Matrix: Water**

**Analysis Batch: 180321**

**Client Sample ID: Method Blank**

**Prep Type: Total Recoverable**

**Prep Batch: 179974**

Analyte	MB	MB	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
	Result	Qualifier							
Silver	ND		5.0	1.2	ug/L				1
Aluminum	38.7	J	200	37	ug/L	06/23/16 07:16	06/27/16 07:21		1
Arsenic	ND		10	4.8	ug/L	06/23/16 07:16	06/27/16 07:21		1
Antimony	ND		10	3.2	ug/L	06/23/16 07:16	06/27/16 07:21		1
Barium	ND		200	3.2	ug/L	06/23/16 07:16	06/27/16 07:21		1
Beryllium	ND		4.0	0.42	ug/L	06/23/16 07:16	06/27/16 07:21		1
Cadmium	ND		5.0	0.20	ug/L	06/23/16 07:16	06/27/16 07:21		1
Calcium	ND		5000	89	ug/L	06/23/16 07:16	06/27/16 07:21		1
Chromium	ND		5.0	0.61	ug/L	06/23/16 07:16	06/27/16 07:21		1
Cobalt	ND		50	0.51	ug/L	06/23/16 07:16	06/27/16 07:21		1
Copper	ND		25	3.4	ug/L	06/23/16 07:16	06/27/16 07:21		1
Iron	ND		100	41	ug/L	06/23/16 07:16	06/27/16 07:21		1
Lead	ND		10	3.1	ug/L	06/23/16 07:16	06/27/16 07:21		1
Magnesium	ND		5000	79	ug/L	06/23/16 07:16	06/27/16 07:21		1
Manganese	ND		15	1.1	ug/L	06/23/16 07:16	06/27/16 07:21		1
Nickel	ND		40	3.2	ug/L	06/23/16 07:16	06/27/16 07:21		1
Potassium	ND		5000	620	ug/L	06/23/16 07:16	06/27/16 07:21		1
Selenium	ND		10	3.8	ug/L	06/23/16 07:16	06/27/16 07:21		1
Sodium	ND		5000	190	ug/L	06/23/16 07:16	06/27/16 07:21		1
Thallium	ND		20	2.6	ug/L	06/23/16 07:16	06/27/16 07:21		1
Vanadium	ND		50	6.9	ug/L	06/23/16 07:16	06/27/16 07:21		1
Zinc	ND		20	6.9	ug/L	06/23/16 07:16	06/27/16 07:21		1

**Lab Sample ID: LCS 180-179974/2-A**

**Matrix: Water**

**Analysis Batch: 180321**

**Client Sample ID: Lab Control Sample**

**Prep Type: Total Recoverable**

**Prep Batch: 179974**

**%Rec.**

**Limits**

Analyte	Spike	LCS	LCS	Unit	D	%Rec	Limits
	Added	Result	Qualifier				
Silver	50.0	52.4		ug/L		105	80 - 120
Aluminum	2000	2030		ug/L		101	80 - 120
Arsenic	500	517		ug/L		103	80 - 120
Antimony	500	524		ug/L		105	80 - 120
Barium	2000	2010		ug/L		101	80 - 120
Beryllium	50.0	51.2		ug/L		102	80 - 120
Cadmium	50.0	51.8		ug/L		104	80 - 120
Calcium	50000	51300		ug/L		103	80 - 120
Chromium	200	195		ug/L		98	80 - 120
Cobalt	500	506		ug/L		101	80 - 120
Copper	250	243		ug/L		97	80 - 120
Iron	1000	1020		ug/L		102	80 - 120
Lead	500	513		ug/L		103	80 - 120
Magnesium	50000	50500		ug/L		101	80 - 120
Manganese	500	477		ug/L		95	80 - 120
Nickel	500	508		ug/L		102	80 - 120
Potassium	50000	50500		ug/L		101	80 - 120
Selenium	500	544		ug/L		109	80 - 120
Sodium	50000	51100		ug/L		102	80 - 120
Thallium	500	516		ug/L		103	80 - 120

TestAmerica Pittsburgh

# QC Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Method: 6010C - Metals (ICP) (Continued)

**Lab Sample ID: LCS 180-179974/2-A**

**Matrix: Water**

**Analysis Batch: 180321**

**Client Sample ID: Lab Control Sample**

**Prep Type: Total Recoverable**

**Prep Batch: 179974**

**%Rec.**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Vanadium	500	526		ug/L		105	80 - 120
Zinc	500	506		ug/L		101	80 - 120

**Lab Sample ID: 180-55922-4 MS**

**Matrix: Water**

**Analysis Batch: 180321**

**Client Sample ID: MW-162**

**Prep Type: Dissolved**

**Prep Batch: 179974**

**%Rec.**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Silver	ND		50.0	54.2		ug/L		108	75 - 125
Aluminum	ND		2000	2050		ug/L		103	75 - 125
Arsenic	ND		500	529		ug/L		106	75 - 125
Antimony	ND		500	534		ug/L		107	75 - 125
Barium	16 J		2000	2050		ug/L		102	75 - 125
Beryllium	ND		50.0	51.1		ug/L		102	75 - 125
Cadmium	ND		50.0	52.8		ug/L		106	75 - 125
Calcium	33000		50000	84500		ug/L		103	75 - 125
Chromium	ND		200	195		ug/L		98	75 - 125
Cobalt	ND		500	513		ug/L		103	75 - 125
Copper	ND		250	249		ug/L		99	75 - 125
Iron	190		1000	1160		ug/L		97	75 - 125
Lead	ND		500	523		ug/L		105	75 - 125
Magnesium	25000		50000	76700		ug/L		102	75 - 125
Manganese	160		500	622		ug/L		93	75 - 125
Nickel	ND		500	514		ug/L		103	75 - 125
Potassium	2900 J		50000	53700		ug/L		102	75 - 125
Selenium	ND		500	565		ug/L		113	75 - 125
Sodium	28000		50000	79700		ug/L		103	75 - 125
Thallium	2.7 J		500	523		ug/L		104	75 - 125
Vanadium	ND		500	531		ug/L		106	75 - 125
Zinc	ND		500	509		ug/L		102	75 - 125

**Lab Sample ID: 180-55922-4 MSD**

**Matrix: Water**

**Analysis Batch: 180321**

**Client Sample ID: MW-162**

**Prep Type: Dissolved**

**Prep Batch: 179974**

**%Rec.**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Silver	ND		50.0	53.5		ug/L		107	75 - 125	1	20
Aluminum	ND		2000	2040		ug/L		102	75 - 125	1	20
Arsenic	ND		500	528		ug/L		106	75 - 125	0	20
Antimony	ND		500	535		ug/L		107	75 - 125	0	20
Barium	16 J		2000	2040		ug/L		101	75 - 125	0	20
Beryllium	ND		50.0	50.6		ug/L		101	75 - 125	1	20
Cadmium	ND		50.0	52.1		ug/L		104	75 - 125	1	20
Calcium	33000		50000	83900		ug/L		102	75 - 125	1	20
Chromium	ND		200	194		ug/L		97	75 - 125	1	20
Cobalt	ND		500	505		ug/L		101	75 - 125	2	20
Copper	ND		250	247		ug/L		99	75 - 125	1	20
Iron	190		1000	1200		ug/L		101	75 - 125	3	20
Lead	ND		500	516		ug/L		103	75 - 125	1	20

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# QC Sample Results

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Method: 6010C - Metals (ICP) (Continued)

**Lab Sample ID: 180-55922-4 MSD**

**Matrix: Water**

**Analysis Batch: 180321**

**Client Sample ID: MW-162**

**Prep Type: Dissolved**

**Prep Batch: 179974**

Analyte	Sample	Sample	Spike	MSD	MSD	Unit	D	%Rec	Limits	RPD	Limit
	Result	Qualifier	Added	Result	Qualifier						
Magnesium	25000		50000	76300		ug/L	102	75 - 125	1	20	
Manganese	160		500	619		ug/L	93	75 - 125	1	20	
Nickel	ND		500	507		ug/L	101	75 - 125	1	20	
Potassium	2900	J	50000	53800		ug/L	102	75 - 125	0	20	
Selenium	ND		500	569		ug/L	114	75 - 125	1	20	
Sodium	28000		50000	79300		ug/L	103	75 - 125	1	20	
Thallium	2.7	J	500	522		ug/L	104	75 - 125	0	20	
Vanadium	ND		500	529		ug/L	106	75 - 125	0	20	
Zinc	ND		500	501		ug/L	100	75 - 125	2	20	

## Method: 7470A - Mercury (CVAA)

**Lab Sample ID: MB 180-179990/1-A**

**Matrix: Water**

**Analysis Batch: 180201**

**Client Sample ID: Method Blank**

**Prep Type: Total/NA**

**Prep Batch: 179990**

Analyte	MB	MB	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
	Result	Qualifier							
Mercury	ND		0.20	0.052	ug/L		06/23/16 08:18	06/24/16 10:57	1

**Lab Sample ID: LCS 180-179990/2-A**

**Matrix: Water**

**Analysis Batch: 180201**

**Client Sample ID: Lab Control Sample**

**Prep Type: Total/NA**

**Prep Batch: 179990**

Analyte	Spike	LCS	LCS	Unit	D	%Rec	Limits
	Added	Result	Qualifier				
Mercury	2.50	2.26		ug/L		90	80 - 120

**Lab Sample ID: 180-55922-4 MS**

**Matrix: Water**

**Analysis Batch: 180201**

**Client Sample ID: MW-162**

**Prep Type: Dissolved**

**Prep Batch: 179990**

Analyte	Sample	Sample	Spike	MS	MS	Unit	D	%Rec	Limits
	Result	Qualifier	Added	Result	Qualifier				
Mercury	ND	F1	1.00	0.803		ug/L	80	75 - 125	

**Lab Sample ID: 180-55922-4 MSD**

**Matrix: Water**

**Analysis Batch: 180201**

**Client Sample ID: MW-162**

**Prep Type: Dissolved**

**Prep Batch: 179990**

Analyte	Sample	Sample	Spike	MSD	MSD	Unit	D	%Rec	Limits	RPD	Limit
	Result	Qualifier	Added	Result	Qualifier						
Mercury	ND	F1	1.00	0.674	F1	ug/L	67	75 - 125	17	20	

TestAmerica Pittsburgh

# QC Association Summary

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## GC/MS VOA

### Analysis Batch: 180008

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-55922-2	FB-01	Total/NA	Water	8260C	5
180-55922-3	MW-120	Total/NA	Water	8260C	6
180-55922-4	MW-162	Total/NA	Water	8260C	7
180-55922-4 MS	MW-162	Total/NA	Water	8260C	8
180-55922-4 MSD	MW-162	Total/NA	Water	8260C	9
180-55922-9	TRIP BLANK	Total/NA	Water	8260C	10
LCS 180-180008/14	Lab Control Sample	Total/NA	Water	8260C	11
MB 180-180008/7	Method Blank	Total/NA	Water	8260C	12

### Analysis Batch: 180105

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-55922-1	MW-160	Total/NA	Water	8260C	10
180-55922-1 MS	MW-160	Total/NA	Water	8260C	11
180-55922-1 MSD	MW-160	Total/NA	Water	8260C	12
180-55922-5	MW-159	Total/NA	Water	8260C	13
180-55922-6	MW-163S	Total/NA	Water	8260C	
180-55922-7	MW-501S	Total/NA	Water	8260C	
180-55922-8	DUP-01	Total/NA	Water	8260C	
LCS 180-180105/3	Lab Control Sample	Total/NA	Water	8260C	
MB 180-180105/6	Method Blank	Total/NA	Water	8260C	

## Metals

### Prep Batch: 179974

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-55922-1	MW-160	Dissolved	Water	3005A	
180-55922-2	FB-01	Dissolved	Water	3005A	
180-55922-3	MW-120	Dissolved	Water	3005A	
180-55922-4	MW-162	Dissolved	Water	3005A	
180-55922-4 MS	MW-162	Dissolved	Water	3005A	
180-55922-4 MSD	MW-162	Dissolved	Water	3005A	
180-55922-5	MW-159	Dissolved	Water	3005A	
180-55922-6	MW-163S	Dissolved	Water	3005A	
180-55922-7	MW-501S	Dissolved	Water	3005A	
180-55922-8	DUP-01	Dissolved	Water	3005A	
LCS 180-179974/2-A	Lab Control Sample	Total Recoverable	Water	3005A	
MB 180-179974/1-A	Method Blank	Total Recoverable	Water	3005A	

### Prep Batch: 179990

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-55922-1	MW-160	Dissolved	Water	7470A	
180-55922-2	FB-01	Dissolved	Water	7470A	
180-55922-3	MW-120	Dissolved	Water	7470A	
180-55922-4	MW-162	Dissolved	Water	7470A	
180-55922-4 MS	MW-162	Dissolved	Water	7470A	
180-55922-4 MSD	MW-162	Dissolved	Water	7470A	
180-55922-5	MW-159	Dissolved	Water	7470A	
180-55922-6	MW-163S	Dissolved	Water	7470A	
180-55922-7	MW-501S	Dissolved	Water	7470A	
180-55922-8	DUP-01	Dissolved	Water	7470A	

TestAmerica Pittsburgh

# QC Association Summary

Client: Tetra Tech, Inc.

Project/Site: Lyondell Beaver Valley Plant Groundwater

TestAmerica Job ID: 180-55922-1

## Metals (Continued)

### Prep Batch: 179990 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 180-179990/2-A	Lab Control Sample	Total/NA	Water	7470A	
MB 180-179990/1-A	Method Blank	Total/NA	Water	7470A	

### Analysis Batch: 180201

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-55922-1	MW-160	Dissolved	Water	7470A	179990
180-55922-2	FB-01	Dissolved	Water	7470A	179990
180-55922-3	MW-120	Dissolved	Water	7470A	179990
180-55922-4	MW-162	Dissolved	Water	7470A	179990
180-55922-4 MS	MW-162	Dissolved	Water	7470A	179990
180-55922-4 MSD	MW-162	Dissolved	Water	7470A	179990
180-55922-5	MW-159	Dissolved	Water	7470A	179990
180-55922-6	MW-163S	Dissolved	Water	7470A	179990
180-55922-7	MW-501S	Dissolved	Water	7470A	179990
180-55922-8	DUP-01	Dissolved	Water	7470A	179990
LCS 180-179990/2-A	Lab Control Sample	Total/NA	Water	7470A	179990
MB 180-179990/1-A	Method Blank	Total/NA	Water	7470A	179990

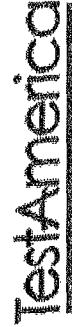
### Analysis Batch: 180321

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-55922-1	MW-160	Dissolved	Water	6010C	179974
180-55922-2	FB-01	Dissolved	Water	6010C	179974
180-55922-3	MW-120	Dissolved	Water	6010C	179974
180-55922-4	MW-162	Dissolved	Water	6010C	179974
180-55922-4 MS	MW-162	Dissolved	Water	6010C	179974
180-55922-4 MSD	MW-162	Dissolved	Water	6010C	179974
180-55922-5	MW-159	Dissolved	Water	6010C	179974
180-55922-5	MW-159	Dissolved	Water	6010C	179974
180-55922-6	MW-163S	Dissolved	Water	6010C	179974
180-55922-6	MW-163S	Dissolved	Water	6010C	179974
180-55922-7	MW-501S	Dissolved	Water	6010C	179974
180-55922-7	MW-501S	Dissolved	Water	6010C	179974
180-55922-7	MW-501S	Dissolved	Water	6010C	179974
180-55922-8	DUP-01	Dissolved	Water	6010C	179974
180-55922-8	DUP-01	Dissolved	Water	6010C	179974
180-55922-8	DUP-01	Dissolved	Water	6010C	179974
LCS 180-179974/2-A	Lab Control Sample	Total Recoverable	Water	6010C	179974
MB 180-179974/1-A	Method Blank	Total Recoverable	Water	6010C	179974

**TestAmerica Pittsburgh**

301 Alpha Drive RIDC Park  
Pittsburgh, PA 15238  
Phone (412) 963-7058 Fax (412) 963-2468

**Chain of Custody Record**



THE LEADER IN ENVIRONMENTAL TESTING

<b>Client Information</b>	
Client Contact:	Mr. Jonathan Aglio
Company:	Tetra Tech, Inc.
Address:	Foster Plaza 7 661 Anderson Drive
City:	Pittsburgh
State, Zip:	PA, 15220-2745
Phone:	(412) 217-3411 (Tel)
Email:	jon.aglio@tetratech.com
Project Name:	Lyondell Beaver Valley Plant Groundwater
Site:	Lyonneil Beaver Valley

Sampler:	Jon Aglio	Lab P/M:	Colussy, Jill L	Carrier Tracking No(s):	PC6-10
Phone:	412-211-7090	E-Mail:	jill.colussy@testamericainc.com	COG No:	180-31292-7050-1
Analysis Requested					
Other / 07/10/09 - 08/14/09					
BTEX - 8360					
Total Number of Components: 6					
Initial Sample (Yes or No): Yes					
Special Instructions/Note:					
Due Date Requested:	TAT Requested (days):  2 weeks.				
PO #:	1120327				
WFO #:					
Project #:	18015267				
SSOW #:					
Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (Water, Solid, Osmotic Cell, ST/Tissue/air)	Preservation Codes:
MW-160	6-20-10	1015	W	X X	A - HCl
FB-01		1130			B - NaOH
MW-120		1200			C - Zn Acetate
MW-142	V	1315			D - Nitric Acid
MW-159	AT 6-21-10	850			E - NaHSO4
MW-163S	6-21-10	1000			F - MeOH
MW-501S		1130			G - Acetone
Dup-01		0000	V	V	H - Ascorbic Acid
TR-8 Blend*	L-A-3			V	I - Ice
					J - DI Water
					K - EDTA
					L - EDA
					M - Hexane
					N - None
					O - AsNaO2
					P - Na2O-S
					Q - Na2S2O3
					R - Na2SO4
					S - H2SO4
					T - TSP Dodecahydrate
					U - Acetone
					V - MCAA
					W - pH 4-5
					Z - other (specify)
					Other:

Possible Hazard Identification	Flammable	Skin Irritant	Poison B	Unknown	Radiological	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Non-Hazard	Return To Client	Disposal By Lab	Archive For	Months		
Deliverable Requested: I, II, III, IV, Other (specify)						Special Instructions/QC Requirements:
Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:			
Relinquished by: Jonathan Aglio	Date/Time: 6-21-10 / 1500	Company: Tetra Tech	Received by:	Date/Time: 6-22-10 / 1530	Company: Tetra Tech	
Relinquished by: Jonathan Aglio	Date/Time: 6-22-10 / 1530	Company: Tetra Tech	Received by:	Date/Time: 6-22-10 / 1530	Company: Tetra Tech	
Custody Seals intact: Yes	Custody Seal No.: 10	Cooler Temperature: °C and Other Remarks:				
△ Yes	△ No	12 11 10 9 8 7 6 5 4 3 2 1				

## Login Sample Receipt Checklist

Client: Tetra Tech, Inc.

Job Number: 180-55922-1

**Login Number: 55922**

**List Source: TestAmerica Pittsburgh**

**List Number: 1**

**Creator: Kovitch, Christina M**

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	False	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

**ATTACHMENT 4**  
**RACCOON CREEK FULL DATA SUMMARY TABLE**

Attachment 4  
 Full Appendix Groundwater Analytical Results  
 Former Lyondell Beaver Valley Site  
 Potter Township, Pennsylvania

LOCATION	MW120	MW120	MW120	MW-120	MW159	MW-159	MW160
SAMPLE ID	MW120	MW120-AVG	MW120-D	MW-120	MW159	MW-159	MW160
SAMPLE DATE	20151109	20151109	20151109	20160620	20151110	20160621	20151111
SAMPLE CODE	ORIG	Avg	DUP	ORIG	ORIG	ORIG	ORIG
MATRIX	GW	GW	GW	GW	GW	GW	GW
<b>DISSOLVED METALS (UG/L)</b>							
ALUMINUM	37 J	38.5	40 J	200 U	200 U	49 JB	200 U
ANTIMONY	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ARSENIC	50 U	30 U	10 U	51	10 U	50 U	4.7 J
BARIUM	60 J	60.5	61 J	160 J	42 J	38 J	62 JB
BERYLLIUM	4 U	0.24 J	0.24 J	4 U	4 U	4 U	4 U
CADMIUM	5 U	5 U	5 U	5 U	0.29 J	0.32 J	5 U
CALCIUM	370000 B	375000	380000 B	110000	220000 B	240000	130000
CHROMIUM	30	34	38	2.8 J	30	19	5 U
COBALT	130	130	130	3 J	27 J	26 J	0.98 J
COPPER	4.2 J	4.45	4.7 J	25 U	3.4 J	25 U	1.4 JB
IRON	91000	91000	91000	35000	39000	34000	30000 B
LEAD	4.1 J	4.05	4 J	10 U	3.8 J	3.2 J	10 U
MAGNESIUM	80000	80500	81000	18000	43000	45000	26000
MANGANESE	98000 B	97500	97000 B	4500	78000 B	69000	4800 B
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
NICKEL	80	80	80	40 U	55	52	14 J
POTASSIUM	2100 JB	2150	2200 JB	4300 J	2200 JB	2800 J	3400 J
SELENIUM	50 U	13 J	13 J	4.2 J	12 J	50 U	4.5 J
SILVER	25 U	25 U	25 U	5 U	3.6 J	25 U	5 U
SODIUM	83000 B	83500	84000 B	94000	110000 B	120000	110000
THALLIUM	26 J	28	30 J	20 U	21 J	18 J	20 U
VANADIUM	9.5 J	10.25	11 J	50 U	5.1 J	8.4 J	50 U
ZINC	22 B	22	22 B	20 U	8.1 JB	39	20 U
<b>TOTAL METALS (UG/L)</b>							
ALUMINUM	47 J	47 J	200 U	NA	60 J	NA	81 J
ANTIMONY	10 U	10 U	10 U	NA	10 U	NA	10 U
ARSENIC	50 U	50 U	50 U	NA	10 U	NA	5.2 J
BARIUM	61 J	60	59 J	NA	43 J	NA	66 JB
BERYLLIUM	4 U	4 U	4 U	NA	0.18 J	NA	4 U
CADMIUM	5 U	5 U	5 U	NA	5 U	NA	5 U
CALCIUM	370000 B	365000	360000 B	NA	230000 B	NA	130000
CHROMIUM	29	29	29	NA	31	NA	5 U
COBALT	130	130	130	NA	28 J	NA	0.99 J
COPPER	3.6 J	3.85	4.1 J	NA	3.7 J	NA	1.2 JB
IRON	91000	90500	90000	NA	43000	NA	35000 B
LEAD	3.8 J	3.4	3 J	NA	5.4 J	NA	10 U
MAGNESIUM	81000	79500	78000	NA	45000	NA	26000
MANGANESE	96000 B	97500	99000 B	NA	77000 B	NA	4900 B
MERCURY	0.2 U	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U
NICKEL	78	79.5	81	NA	57	NA	14 J
POTASSIUM	2200 JB	2150	2100 JB	NA	2300 JB	NA	3500 J
SELENIUM	18 J	18 J	50 U	NA	50 U	NA	5.6 J
SILVER	25 U	3.8 J	3.8 J	NA	25 U	NA	5 U
SODIUM	84000 B	83000	82000 B	NA	120000 B	NA	110000
THALLIUM	27 J	28.5	30 J	NA	17 J	NA	20 U
VANADIUM	7.6 J	9.3	11 J	NA	7.3 J	NA	50 U
ZINC	23 B	22.5	22 B	NA	14 JB	NA	20 U
<b>SEMOVOLATILES (UG/L)</b>							
1,1-BIPHENYL	8.1 U	8.2 U	8.3 U	NA	13	NA	2 J
2,2'-OXYBIS(1-CHLOROPROPANE)	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
2,4,5-TRICHLOROPHENOL	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
2,4,6-TRICHLOROPHENOL	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
2,4-DICHLOROPHENOL	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
2,4-DIMETHYLPHENOL	3.3 J	3.45	3.6 J	NA	2.4 J	NA	4.5 J
2,4-DINITROPHENOL	40 U	41 U	42 U	NA	39 U	NA	42 U
2,4-DINITROTOLUENE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
2,6-DINITROTOLUENE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
2-CHLORONAPHTHALENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
2-CHLOROPHENOL	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
2-METHYLNAPHTHALENE	1.6 U	1.65 U	1.7 U	NA	1.2 J	NA	1.7 U
2-METHYLPHENOL	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
2-NITROANILINE	40 U	41 U	42 U	NA	39 U	NA	42 U^c
2-NITROPHENOL	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
3&4-METHYLPHENOL	3.1 J	3.2	3.3 J	NA	2.7 J	NA	2.6 J
3,3'-DICHLOROBENZIDINE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
3-NITROANILINE	40 U	41 U	42 U	NA	39 U	NA	42 U
4,6-DINITRO-2-METHYLPHENOL	40 U	41 U	42 U	NA	39 U	NA	42 U
4-BROMOPHENYL PHENYL ETHER	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
4-CHLORO-3-METHYLPHENOL	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
4-CHLOROANILINE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
4-CHLOROPHENYL PHENYL ETHER	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
4-NITROANILINE	40 U	41 U	42 U	NA	39 U	NA	42 U
4-NITROPHENOL	40 U	41 U	42 U	NA	39 U	NA	42 U
ACENAPHTHENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
ACENAPHTHYLENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
ACETOPHENONE	16	16	16 J	NA	14 J	NA	19
ANTHRACENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
ATRAZINE	16 U	16.5 U	17 U	NA	16 U	NA	17 U
BENZALDEHYDE	16 U	16.5 U	17 U	NA	3.2 J	NA	17 U
BENZO(A)ANTHRACENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
BENZO(A)PYRENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
BENZO(B)FLUORANTHENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
BENZO(G,H,I)PERYLENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
BENZO(K)FLUORANTHENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
BIS(2-CHLOROETHOXY)METHANE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
BIS(2-CHLOROETHYL)ETHER	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
BIS(2-ETHYLHEXYL)PHTHALATE	16 U	16.5 U	17 U	NA	16 U	NA	13 J
BUTYL BENZYL PHTHALATE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U

Attachment 4  
 Full Appendix Groundwater Analytical Results  
 Former Lyondell Beaver Valley Site  
 Potter Township, Pennsylvania

LOCATION	MW120	MW120	MW120	MW-120	MW159	MW-159	MW160
SAMPLE ID	MW120	MW120-AVG	MW120-D	MW-120	MW159	MW-159	MW160
SAMPLE DATE	20151109	20151109	20151109	20160620	20151110	20160621	20151111
SAMPLE CODE	ORIG	AVG	DUP	ORIG	ORIG	ORIG	ORIG
MATRIX	GW	GW	GW	GW	GW	GW	GW
CAPROLACTAM	40 U	41 U	42 U	NA	39 U	NA	42 U
CARBAZOLE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
CHRYSENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
DIBENZO(A,H)ANTHRACENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
DIBENZOFURAN	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
DIETHYL PHTHALATE	3.2 J	3.2 J	8.3 U	NA	7.6 J	NA	3 J
DIMETHYL PHTHALATE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
DI-N-BUTYL PHTHALATE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
DI-N-OCTYL PHTHALATE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
FLUORANTHENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
FLUORENE	1.6 U	1.65 U	1.7 U	NA	3.1	NA	0.66 J
HEXACHLOROBENZENE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
HEXACHLOROBUTADIENE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
HEXACHLOROCYCLOPENTADIENE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
HEXACHLOROETHANE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
INDENO(1,2,3-CD)PYRENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
ISOPHORONE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
NAPHTHALENE	0.98 J	0.925	0.87 J	NA	26	NA	1.7 U
NITROBENZENE	16 U	16.5 U	17 U	NA	16 U	NA	17 U
N-NITROSO-DI-N-PROPYLAMINE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
N-NITROSODIPHENYLAMINE	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
PENTACHLOROPHENOL	8.1 U	8.2 U	8.3 U	NA	7.8 U	NA	8.3 U
PHENANTHRENE	1.6 U	1.65 U	1.7 U	NA	5.1	NA	1.7 U
PHENOL	22	21	20	NA	13	NA	3.6 J
PYRENE	1.6 U	1.65 U	1.7 U	NA	1.6 U	NA	1.7 U
<b>VOLATILES (UG/L)</b>							
1,1,1-TRICHLOROETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,1,2,2-TETRACHLOROETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,1,2-TRICHLOROETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,1,2-TRICHLOROTRIFLUOROETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,1-DICHLOROETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,1-DICHLOROETHENE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,2,4-TRICHLOROBENZENE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,2-DIBROMO-3-CHLOROPROPANE	500 U	500 U	500 U	NA	500 U	NA	100 U^c
1,2-DIBROMOETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,2-DICHLOROBENZENE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,2-DICHLOROETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,2-DICHLOROPROPANE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,3-DICHLOROBENZENE	500 U	500 U	500 U	NA	500 U	NA	100 U
1,4-DICHLOROBENZENE	500 U	500 U	500 U	NA	500 U	NA	100 U
2-BUTANONE	500 U^c	500 U	500 U^c	NA	500 U^c	NA	100 U^c
2-HEXANONE	500 U^c	500 U	500 U^c	NA	500 U^c	NA	100 U^c
4-METHYL-2-PENTANONE	500 U^c	500 U	500 U^c	NA	500 U^c	NA	100 U^c
ACETONE	2000 U^c	2000 U	2000 U^c	NA	2000 U^c	NA	400 U
BENZENE	4100	4000	3900	5 U	25000	53000	770
BROMODICHLOROMETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
BROMOFORM	500 U^c	500 U	500 U^c	NA	500 U^c	NA	100 U*^c
BROMOMETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
CARBON DISULFIDE	500 U	500 U	500 U	NA	500 U	NA	100 U
CARBON TETRACHLORIDE	500 U	500 U	500 U	NA	500 U	NA	100 U
CHLOROBENZENE	500 U	500 U	500 U	NA	500 U	NA	100 U
CHLORODIBROMOMETHANE	500 U^c	500 U	500 U^c	NA	500 U^c	NA	100 U*^c
CHLOROETHANE	500 U^c	500 U	500 U^c	NA	500 U^c	NA	100 U
CHLOROFORM	500 U	500 U	500 U	NA	500 U	NA	100 U
CHLORMETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
CIS-1,2-DICHLOROETHENE	500 U	500 U	500 U	NA	500 U	NA	100 U
CIS-1,3-DICHLOROPROPENE	500 U	500 U	500 U	NA	500 U	NA	100 U
CYCLOHEXANE	500 U	500 U	500 U	NA	500 U	NA	100 U
DICHLORODIFLUOROMETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
ETHYLBENZENE	500 U	500 U	500 U	5 U	500 U	5000 U	100 U
ISOPROPYLBENZENE	500 U	500 U	500 U	NA	500 U	NA	100 U
METHYL ACETATE	2500 U	2500 U	2500 U	NA	2500 U	NA	500 U
METHYL CYCLOHEXANE	500 U	500 U	500 U	NA	500 U	NA	100 U
METHYL TERT-BUTYL ETHER	500 U	500 U	500 U	NA	500 U	NA	100 U
METHYLENE CHLORIDE	500 U	500 U	500 U	NA	500 U	NA	100 U
STYRENE	500 U	500 U	500 U	NA	500 U	NA	100 U
TETRACHLOROETHENE	500 U	500 U	500 U	NA	500 U	NA	100 U
TOLUENE	500 U	500 U	500 U	5 U	500 U	5000 U	100 U
TOTAL XYLEMES	1000 U	1000 U	1000 U	10 U	1000 U	10000 U	200 U
TRANS-1,2-DICHLOROETHENE	500 U	500 U	500 U	NA	500 U	NA	100 U
TRANS-1,3-DICHLOROPROPENE	500 U	500 U	500 U	NA	500 U	NA	100 U
TRICHLOROETHENE	500 U	500 U	500 U	NA	500 U	NA	100 U
TRICHLOROFLUOROMETHANE	500 U	500 U	500 U	NA	500 U	NA	100 U
VINYL CHLORIDE	500 U	500 U	500 U	NA	500 U	NA	100 U

ug/L = micrograms per liter

U = Below Reporting Limit

B = Detected in Method Blank

J = Estimated Result

GW = Groundwater

ORIG = Original or Parent Sample

AVG = Average of Original and Duplicate Sample

DUP = Duplicate Sample

Attachment 4  
 Full Appendix Groundwater Analytical Results  
 Former Lyondell Beaver Valley Site  
 Potter Township, Pennsylvania

LOCATION	MW-160	MW162	MW-162	MW163S	MW-163S	MW501S	MW-501S
SAMPLE ID	MW-160	MW162	MW-162	MW163S	MW-163S	MW501S	MW-501S
SAMPLE DATE	20160620	20151109	20160620	20151110	20160621	20151111	20160621
SAMPLE CODE	ORIG	ORIG	ORIG	ORIG	ORIG	ORIG	ORIG
MATRIX	GW	GW	GW	GW	GW	GW	GW
<b>DISSOLVED METALS (UG/L)</b>							
ALUMINUM	200 U	200 U	200 U	6200	20000 B	940000	850000 B
ANTIMONY	10 U	50 U	50 U				
ARSENIC	10 U	10 U	10 U	10 U	20 U	50	32
BARIUM	52 J	110 J	16 J	22 J	18 J	6.6 JB	400 U
BERYLLIUM	4 U	0.16 JB	4 U	1.7 J	3.6 J	43 B	40
CADMIUM	5 U	5 U	5 U	5 U	5 U	25 U	5.8 J
CALCIUM	69000	290000	33000	120000 B	150000	390000	340000
CHROMIUM	5 U	1.6 J	5 U	40	110	380	340
COBALT	1.5 J	1.6 J	50 U	74	150	500	480
COPPER	25 U	3.2 JB	25 U	25 U	25 U	220 B	200
IRON	11000	87000	190	210000	330000	1300000 B	1300000
LEAD	10 U	10 U	10 U	2.1 J	6.7 J	30 J	18 J
MAGNESIUM	8200	77000	25000	26000	36000	200000	180000
MANGANESE	1700	14000 B	160	25000 B	31000	21000 B	18000
MERCURY	0.2 U	0.2 U	0.2 UF1	0.2 U	0.057 J	0.2 U	0.07 J
NICKEL	4.5 J	2.2 J	40 U	130	290	1300	1400
POTASSIUM	4500 J	4800 JB	2900 J	2100 JB	2600 J	130000	110000
SELENIUM	4.6 J	10 U	10 U	5.3 J	20 U	50 U	27
SILVER	5 U	5 U	5 U	5 U	10 U	25 U	10 U
SODIUM	51000	41000 B	28000	78000 B	72000	53000	50000
THALLIUM	20 U	20 U	2.7 J	7.5 J	16 J	100 U	20 U
VANADIUM	50 U	50 U	50 U	5.5 J	24 J	830	1000
ZINC	20 U	3.5 J	20 U	19 JB	14 J	3500 B	3000
<b>TOTAL METALS (UG/L)</b>							
ALUMINUM	NA	130 J	NA	7600	NA	960000	NA
ANTIMONY	NA	10 U	NA	10 U	NA	50 U	NA
ARSENIC	NA	10 U	NA	10 U	NA	32 J	NA
BARIUM	NA	99 J	NA	24 J	NA	6.3 JB	NA
BERYLLIUM	NA	4 U	NA	1.8 J	NA	44 B	NA
CADMIUM	NA	5 U	NA	5 U	NA	25 U	NA
CALCIUM	NA	270000 B	NA	120000 B	NA	400000	NA
CHROMIUM	NA	5.2	NA	44	NA	390	NA
COBALT	NA	0.91 J	NA	69	NA	510	NA
COPPER	NA	1.9 J	NA	25 U	NA	230 B	NA
IRON	NA	79000	NA	200000	NA	1300000 B	NA
LEAD	NA	10 U	NA	3.3 J	NA	21 J	NA
MAGNESIUM	NA	71000	NA	26000	NA	200000	NA
MANGANESE	NA	12000 B	NA	19000 B	NA	21000 B	NA
MERCURY	NA	0.2 U	NA	0.2 U	NA	0.2 U	NA
NICKEL	NA	1.8 J	NA	120	NA	1400	NA
POTASSIUM	NA	4500 JB	NA	2100 JB	NA	130000	NA
SELENIUM	NA	5.1 J	NA	4 J	NA	23 J	NA
SILVER	NA	5 U	NA	5 U	NA	25 U	NA
SODIUM	NA	40000 B	NA	79000 B	NA	54000	NA
THALLIUM	NA	2.6 J	NA	3.9 J	NA	100 U	NA
VANADIUM	NA	50 U	NA	6.8 J	NA	860	NA
ZINC	NA	4.3 JB	NA	13 JB	NA	3600 B	NA
<b>SEMIVOLATILES (UG/L)</b>							
1,1-BIPHENYL	NA	7.6 U	NA	8.9 U	NA	1.3 J	NA
2,2'-OXYBIS(1-CHLOROPROPANE)	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
2,4,5-TRICHLOROPHENOL	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
2,4,6-TRICHLOROPHENOL	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
2,4-DICHLOROPHENOL	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
2,4-DIMETHYLPHENOL	NA	2.9 J	NA	8.9 U	NA	5.2 J	NA
2,4-DINITROPHENOL	NA	38 U	NA	45 U	NA	45 U	NA
2,4-DINITROTOLUENE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
2,6-DINITROTOLUENE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
2-CHLORONAPHTHALENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
2-CHLOROPHENOL	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
2-METHYLNAPHTHALENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
2-METHYLPHENOL	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
2-NITROANILINE	NA	38 U	NA	45 U	NA	45 U^c	NA
2-NITROPHENOL	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
3&4-METHYLPHENOL	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
3,3'-DICHLOROBENZIDINE	NA	7.6 UF1	NA	8.9 U	NA	8.9 U	NA
3-NITROANILINE	NA	38 U	NA	45 U	NA	45 U	NA
4,6-DINITRO-2-METHYLPHENOL	NA	38 U	NA	45 U	NA	45 U	NA
4-BROMOPHENYL PHENYL ETHER	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
4-CHLORO-3-METHYLPHENOL	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
4-CHLOROANILINE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
4-CHLOROPHENYL PHENYL ETHER	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
4-NITROANILINE	NA	38 U	NA	45 U	NA	45 U	NA
4-NITROPHENOL	NA	38 U	NA	45 U	NA	45 U	NA
ACENAPHTHENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
ACENAPHTHYLENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
ACETOPHENONE	NA	9.5 J	NA	1.8 J	NA	610	NA
ANTHRACENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
ATRAZINE	NA	15 U	NA	18 U	NA	18 U	NA
BENZALDEHYDE	NA	15 U	NA	18 U	NA	18 U	NA
BENZO(A)ANTHRACENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
BENZO(A)PYRENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
BENZO(B)FLUORANTHENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
BENZO(G,H,I)PERYLENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
BENZO(K)FLUORANTHENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
BIS(2-CHLOROETHOXY)METHANE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
BIS(2-CHLOROETHYL)ETHER	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
BIS(2-ETHYLHEXYL)PHTHALATE	NA	15 U	NA	18 U	NA	6.1 J	NA
BUTYL BENZYL PHTHALATE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA

Attachment 4  
 Full Appendix Groundwater Analytical Results  
 Former Lyondell Beaver Valley Site  
 Potter Township, Pennsylvania

LOCATION	MW-160	MW162	MW-162	MW163S	MW-163S	MW501S	MW-501S
SAMPLE ID	MW-160	MW162	MW-162	MW163S	MW-163S	MW501S	MW-501S
SAMPLE DATE	20160620	20151109	20160620	20151110	20160621	20151111	20160621
SAMPLE CODE	ORIG						
MATRIX	GW						
CAPROLACTAM	NA	38 U	NA	45 U	NA	45 U	NA
CARBAZOLE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
CHRYSENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
DIBENZO(A,H)ANTHRACENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
DIBENZOFURAN	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
DIETHYL PHTHALATE	NA	4.5 J	NA	8.9 U	NA	4 J	NA
DIMETHYL PHTHALATE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
DI-N-BUTYL PHTHALATE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
DI-N-OCTYL PHTHALATE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
FLUORANTHENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
FLUORENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
HEXACHLOROBENZENE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
HEXACHLOROBUTADIENE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
HEXACHLOROCYCLOPENTADIENE	NA	7.6 UF1	NA	8.9 U	NA	8.9 U	NA
HEXACHLOROETHANE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
INDENO(1,2,3-CD)PYRENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
ISOPHORONE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
NAPHTHALENE	NA	3.7	NA	2.4	NA	20	NA
NITROBENZENE	NA	15 U	NA	18 U	NA	18 U	NA
N-NITROSO-DI-N-PROPYLAMINE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
N-NITROSODIPHENYLAMINE	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
PENTACHLOROPHENOL	NA	7.6 U	NA	8.9 U	NA	8.9 U	NA
PHENANTHRENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
PHENOL	NA	150 F1	NA	8.9 U	NA	100	NA
PYRENE	NA	1.5 U	NA	1.8 U	NA	1.8 U	NA
<b>VOLATILES (UG/L)</b>							
1,1,1-TRICHLOROETHANE	NA	500 U	NA	500 U	NA	500 U	NA
1,1,2,2-TETRACHLOROETHANE	NA	500 U	NA	500 U	NA	500 U	NA
1,1,2-TRICHLOROETHANE	NA	500 U	NA	500 U	NA	500 U	NA
1,1,2,2-TRICHLOROTRIFLUOROETHANE	NA	500 U	NA	500 U	NA	500 U	NA
1,1-DICHLOROETHANE	NA	500 U	NA	500 U	NA	500 U	NA
1,1-DICHLOROETHENE	NA	500 U	NA	500 U	NA	500 U	NA
1,2,4-TRICHLOROBENZENE	NA	500 U	NA	500 U	NA	500 U	NA
1,2-DIBROMO-3-CHLOROPROPANE	NA	500 U	NA	500 U	NA	500 U	NA
1,2-DIBROMOETHANE	NA	500 U	NA	500 U	NA	500 U	NA
1,2-DICHLOROBENZENE	NA	500 U	NA	500 U	NA	500 U	NA
1,2-DICHLOROETHANE	NA	500 U	NA	500 U	NA	500 U	NA
1,2-DICHLOROPROPANE	NA	500 U	NA	500 U	NA	500 U	NA
1,3-DICHLOROBENZENE	NA	500 U	NA	500 U	NA	500 U	NA
1,4-DICHLOROBENZENE	NA	500 U	NA	500 U	NA	500 U	NA
2-BUTANONE	NA	500 U^c	NA	500 U^c	NA	500 U	NA
2-HEXANONE	NA	500 U^c	NA	500 U^c	NA	500 U	NA
4-METHYL-2-PENTANONE	NA	500 U^c	NA	500 U^c	NA	500 U	NA
ACETONE	NA	2000 U^c	NA	2000 U^c	NA	2000 U	NA
BENZENE	5 U	16000	100 F1	3000	5300	95000	66000
BROMODICHLOROMETHANE	NA	500 U	NA	500 U	NA	500 U	NA
BROMOFORM	NA	500 U^c	NA	500 U^c	NA	500 U	NA
BROMOMETHANE	NA	500 U	NA	500 U	NA	500 U	NA
CARBON DISULFIDE	NA	500 U	NA	500 U	NA	500 U	NA
CARBON TETRACHLORIDE	NA	500 U	NA	500 U	NA	500 U	NA
CHLOROBENZENE	NA	500 U	NA	500 U	NA	500 U	NA
CHLORODIBROMOMETHANE	NA	500 U^c	NA	500 U^c	NA	500 U	NA
CHLOROETHANE	NA	500 U^c	NA	500 U^c	NA	500 U	NA
CHLOROFORM	NA	500 U	NA	500 U	NA	500 U	NA
CHLORMETHANE	NA	500 U	NA	500 U	NA	500 U	NA
CIS-1,2-DICHLOROETHENE	NA	500 U	NA	500 U	NA	500 U	NA
CIS-1,3-DICHLOROPROPENE	NA	500 U	NA	500 U	NA	500 U	NA
CYCLOHEXANE	NA	500 U	NA	500 U	NA	500 U	NA
DICHLORODIFLUOROMETHANE	NA	500 U	NA	500 U	NA	500 U	NA
ETHYLBENZENE	5 U	100 J	5 U	500 U	500 U	420 J	5000 U
ISOPROPYLBENZENE	NA	500 U	NA	500 U	NA	500 U	NA
METHYL ACETATE	NA	2500 U	NA	2500 U	NA	2500 U	NA
METHYL CYCLOHEXANE	NA	500 U	NA	500 U	NA	500 U	NA
METHYL TERT-BUTYL ETHER	NA	500 U	NA	500 U	NA	500 U	NA
METHYLENE CHLORIDE	NA	500 U	NA	500 U	NA	500 U	NA
STYRENE	NA	500 U	NA	500 U	NA	500 U	NA
TETRACHLOROETHENE	NA	500 U	NA	500 U	NA	500 U	NA
TOLUENE	5 U	170 J	5 U	500 U	500 U	1300	5000 U
TOTAL XYLEMES	10 U	1000 U	10 U	1000 U	1000 U	590 J	10000 U
TRANS-1,2-DICHLOROETHENE	NA	500 U	NA	500 U	NA	500 U	NA
TRANS-1,3-DICHLOROPROPENE	NA	500 U	NA	500 U	NA	500 U	NA
TRICHLOROETHENE	NA	500 U	NA	500 U	NA	500 U	NA
TRICHLOROFLUOROMETHANE	NA	500 U	NA	500 U	NA	500 U	NA
VINYL CHLORIDE	NA	500 U	NA	500 U	NA	500 U	NA

ug/L = micrograms per liter

U = Below Reporting Limit

B = Detected in Method Blank

J = Estimated Result

GW = Groundwater

ORIG = Original or Parent Sample

AVG = Average of Original and Duplicate

DUP = Duplicate Sample

Attachment 4  
 Full Appendix Groundwater Analytical Results  
 Former Lyondell Beaver Valley Site  
 Potter Township, Pennsylvania

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX	MW-501S MW-501S-AVG 20160621 AVG GW	MW-501S MW-501S-D 20160621 DUP GW	QC FB-20151111 20151111 ORIG QC	QC FB-01 20160620 ORIG QC	QC TB-20151110 20151110 ORIG QC	QC TB-20151111 20151111 ORIG QC	QC TRIP BLANK 20160621 ORIG QC
<b>DISSOLVED METALS (UG/L)</b>							
ALUMINUM	845000 B	840000 B	200 U	200 U	--	--	NA
ANTIMONY	50 U	50 U	10 U	10 U	--	--	NA
ARSENIC	29.5	27	10 U	10 U	--	--	NA
BARIUM	400 U	400 U	0.47 J	200 U	--	--	NA
BERYLLIUM	40	40	4 U	4 U	--	--	NA
CADMIUM	5.75 J	5.7 J	5 U	5 U	--	--	NA
CALCIUM	340000	340000	5000 U	5000 U	--	--	NA
CHROMIUM	340	340	5 U	5 U	--	--	NA
COBALT	480	480	50 U	50 U	--	--	NA
COPPER	200	200	1.3 JB	25 U	--	--	NA
IRON	1250000	1200000	100 U	110	--	--	NA
LEAD	22.5 J	27 J	10 U	10 U	--	--	NA
MAGNESIUM	180000	180000	5000 U	5000 U	--	--	NA
MANGANESE	18000	18000	1.8 JB	15 U	--	--	NA
MERCURY	0.07 J	0.2 U	0.2 U	0.2 U	--	--	NA
NICKEL	1350	1300	40 U	40 U	--	--	NA
POTASSIUM	110000	110000	120 JB	5000 U	--	--	NA
SELENIUM	21.5 J	16 J	10 U	10 U	--	--	NA
SILVER	10 U	10 U	5 U	5 U	--	--	NA
SODIUM	49500	49000	740 JB	940 J	--	--	NA
THALLIUM	5 J	5 J	1.5 J	20 U	--	--	NA
VANADIUM	975	950	50 U	50 U	--	--	NA
ZINC	3000	3000	20 U	20 U	--	--	NA
<b>TOTAL METALS (UG/L)</b>							
ALUMINUM	NA	NA	200 U	NA	--	--	NA
ANTIMONY	NA	NA	10 U	NA	--	--	NA
ARSENIC	NA	NA	10 U	NA	--	--	NA
BARIUM	NA	NA	0.75 J	NA	--	--	NA
BERYLLIUM	NA	NA	4 U	NA	--	--	NA
CADMIUM	NA	NA	5 U	NA	--	--	NA
CALCIUM	NA	NA	150 J	NA	--	--	NA
CHROMIUM	NA	NA	5 U	NA	--	--	NA
COBALT	NA	NA	50 U	NA	--	--	NA
COPPER	NA	NA	1.6 JB	NA	--	--	NA
IRON	NA	NA	36 J	NA	--	--	NA
LEAD	NA	NA	10 U	NA	--	--	NA
MAGNESIUM	NA	NA	38 J	NA	--	--	NA
MANGANESE	NA	NA	5.2 JB	NA	--	--	NA
MERCURY	NA	NA	0.2 U	NA	--	--	NA
NICKEL	NA	NA	40 U	NA	--	--	NA
POTASSIUM	NA	NA	120 JB	NA	--	--	NA
SELENIUM	NA	NA	10 U	NA	--	--	NA
SILVER	NA	NA	5 U	NA	--	--	NA
SODIUM	NA	NA	790 JB	NA	--	--	NA
THALLIUM	NA	NA	20 U	NA	--	--	NA
VANADIUM	NA	NA	50 U	NA	--	--	NA
ZINC	NA	NA	20 U	NA	--	--	NA
<b>SEMOVOLATILES (UG/L)</b>							
1,1-BIPHENYL	NA	NA	8.3 U	NA	--	--	NA
2,2'-OXYBIS(1-CHLOROPROPANE)	NA	NA	8.3 U	NA	--	--	NA
2,4,5-TRICHLOROPHENOL	NA	NA	8.3 U	NA	--	--	NA
2,4,6-TRICHLOROPHENOL	NA	NA	8.3 U	NA	--	--	NA
2,4-DICHLOROPHENOL	NA	NA	8.3 U	NA	--	--	NA
2,4-DIMETHYLPHENOL	NA	NA	8.3 U	NA	--	--	NA
2,4-DINITROPHENOL	NA	NA	42 U	NA	--	--	NA
2,4-DINITROTOLUENE	NA	NA	8.3 U	NA	--	--	NA
2,6-DINITROTOLUENE	NA	NA	8.3 U	NA	--	--	NA
2-CHLORONAPHTHALENE	NA	NA	1.7 U	NA	--	--	NA
2-CHLOROPHENOL	NA	NA	8.3 U	NA	--	--	NA
2-METHYLNAPHTHALENE	NA	NA	1.7 U	NA	--	--	NA
2-METHYLPHENOL	NA	NA	8.3 U	NA	--	--	NA
2-NITROANILINE	NA	NA	42 U^c	NA	--	--	NA
2-NITROPHENOL	NA	NA	8.3 U	NA	--	--	NA
3&4-METHYLPHENOL	NA	NA	8.3 U	NA	--	--	NA
3,3'-DICHLOROBENZIDINE	NA	NA	8.3 U	NA	--	--	NA
3-NITROANILINE	NA	NA	42 U	NA	--	--	NA
4,6-DINITRO-2-METHYLPHENOL	NA	NA	42 U	NA	--	--	NA
4-BROMOPHENYL PHENYL ETHER	NA	NA	8.3 U	NA	--	--	NA
4-CHLORO-3-METHYLPHENOL	NA	NA	8.3 U	NA	--	--	NA
4-CHLOROANILINE	NA	NA	8.3 U	NA	--	--	NA
4-CHLOROPHENYL PHENYL ETHER	NA	NA	8.3 U	NA	--	--	NA
4-NITROANILINE	NA	NA	42 U	NA	--	--	NA
4-NITROPHENOL	NA	NA	42 U	NA	--	--	NA
ACENAPHTHENE	NA	NA	1.7 U	NA	--	--	NA
ACENAPHTHYLENE	NA	NA	1.7 U	NA	--	--	NA
ACETOPHENONE	NA	NA	17 U	NA	--	--	NA
ANTHRACENE	NA	NA	1.7 U	NA	--	--	NA
ATRAZINE	NA	NA	17 U	NA	--	--	NA
BENZALDEHYDE	NA	NA	17 U	NA	--	--	NA
BENZO(A)ANTHRACENE	NA	NA	1.7 U	NA	--	--	NA
BENZO(A)PYRENE	NA	NA	1.7 U	NA	--	--	NA
BENZO(B)FLUORANTHENE	NA	NA	1.7 U	NA	--	--	NA
BENZO(G,H,I)PERYLENE	NA	NA	1.7 U	NA	--	--	NA
BENZO(K)FLUORANTHENE	NA	NA	1.7 U	NA	--	--	NA
BIS(2-CHLOROETHOXY)METHANE	NA	NA	8.3 U	NA	--	--	NA
BIS(2-CHLOROETHYL)ETHER	NA	NA	8.3 U	NA	--	--	NA
BIS(2-ETHYLHEXYL)PHTHALATE	NA	NA	12 J	NA	--	--	NA
BUTYL BENZYL PHTHALATE	NA	NA	8.3 U	NA	--	--	NA

Attachment 4  
 Full Appendix Groundwater Analytical Results  
 Former Lyondell Beaver Valley Site  
 Potter Township, Pennsylvania

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX	MW-501S MW-501S-AVG 20160621	MW-501S MW-501S-D 20160621	QC FB-20151111 20151111	QC FB-01 20160620	QC TB-20151110 20151110	QC TB-20151111 20151111	QC TRIP BLANK 20160621
	AVG GW	DUP GW	ORIG QC	ORIG QC	ORIG QC	ORIG QC	ORIG QC
CAPROLACTAM	NA	NA	42 U	NA	--	--	NA
CARBAZOLE	NA	NA	8.3 U	NA	--	--	NA
CHRYSENE	NA	NA	1.7 U	NA	--	--	NA
DIBENZO(A,H)ANTHRACENE	NA	NA	1.7 U	NA	--	--	NA
DIBENZOFURAN	NA	NA	8.3 U	NA	--	--	NA
DIETHYL PHTHALATE	NA	NA	8.3 U	NA	--	--	NA
DIMETHYL PHTHALATE	NA	NA	8.3 U	NA	--	--	NA
DI-N-BUTYL PHTHALATE	NA	NA	8.3 U	NA	--	--	NA
DI-N-OCTYL PHTHALATE	NA	NA	8.3 U	NA	--	--	NA
FLUORANTHENE	NA	NA	1.7 U	NA	--	--	NA
FLUORENE	NA	NA	1.7 U	NA	--	--	NA
HEXACHLOROBENZENE	NA	NA	8.3 U	NA	--	--	NA
HEXACHLOROBUTADIENE	NA	NA	8.3 U	NA	--	--	NA
HEXACHLOROCYCLOPENTADIENE	NA	NA	8.3 U	NA	--	--	NA
HEXACHLOROETHANE	NA	NA	8.3 U	NA	--	--	NA
INDENO(1,2,3-CD)PYRENE	NA	NA	1.7 U	NA	--	--	NA
ISOPHORONE	NA	NA	8.3 U	NA	--	--	NA
NAPHTHALENE	NA	NA	1.7 U	NA	--	--	NA
NITROBENZENE	NA	NA	17 U	NA	--	--	NA
N-NITROSO-DI-N-PROPYLAMINE	NA	NA	8.3 U	NA	--	--	NA
N-NITROSODIPHENYLAMINE	NA	NA	8.3 U	NA	--	--	NA
PENTACHLOROPHENOL	NA	NA	8.3 U	NA	--	--	NA
PHENANTHRENE	NA	NA	1.7 U	NA	--	--	NA
PHENOL	NA	NA	8.3 U	NA	--	--	NA
PYRENE	NA	NA	1.7 U	NA	--	--	NA
<b>VOLATILES (UG/L)</b>							
1,1,1-TRICHLOROETHANE	NA	NA	5 U	NA	5 U	5 U	NA
1,1,2,2-TETRACHLOROETHANE	NA	NA	5 U	NA	5 U	5 U	NA
1,1,2-TRICHLOROETHANE	NA	NA	5 U	NA	5 U	5 U	NA
1,1,2,2-TRICHLOROTRIFLUOROETHANE	NA	NA	5 U	NA	5 U	5 U	NA
1,1-DICHLOROETHANE	NA	NA	5 U	NA	5 U	5 U	NA
1,1-DICHLOROETHENE	NA	NA	5 U	NA	5 U	5 U	NA
1,2,4-TRICHLOROBENZENE	NA	NA	5 U	NA	5 U	5 U	NA
1,2-DIBROMO-3-CHLOROPROPANE	NA	NA	5 U	NA	5 U	5 U	NA
1,2-DIBROMOETHANE	NA	NA	5 U	NA	5 U	5 U	NA
1,2-DICHLOROBENZENE	NA	NA	5 U	NA	5 U	5 U	NA
1,2-DICHLOROETHANE	NA	NA	5 U	NA	5 U	5 U	NA
1,2-DICHLOROPROPANE	NA	NA	5 U	NA	5 U	5 U	NA
1,3-DICHLOROBENZENE	NA	NA	5 U	NA	5 U	5 U	NA
1,4-DICHLOROBENZENE	NA	NA	5 U	NA	5 U	5 U	NA
2-BUTANONE	NA	NA	5 U	NA	5 U	5 U	NA
2-HEXANONE	NA	NA	5 U	NA	5 U	5 U	NA
4-METHYL-2-PENTANONE	NA	NA	5 U	NA	5 U	5 U	NA
ACETONE	NA	NA	20 U	NA	20 U	20 U	NA
BENZENE	69000	72000	5 U	5 U	5 U	5 U	5 U
BROMODICHLOROMETHANE	NA	NA	5 U	NA	5 U	5 U	NA
BROMOFORM	NA	NA	5 U	NA	5 U	5 U	NA
BROMOMETHANE	NA	NA	5 U	NA	5 U	5 U	NA
CARBON DISULFIDE	NA	NA	5 U	NA	5 U	5 U	NA
CARBON TETRACHLORIDE	NA	NA	5 U	NA	5 U	5 U	NA
CHLOROBENZENE	NA	NA	5 U	NA	5 U	5 U	NA
CHLORODIBROMOMETHANE	NA	NA	5 U	NA	5 U	5 U	NA
CHLOROETHANE	NA	NA	5 U	NA	5 U	5 U	NA
CHLOROFORM	NA	NA	5 U	NA	5 U	5 U	NA
CHLOROMETHANE	NA	NA	5 U	NA	5 U	5 U	NA
CIS-1,2-DICHLOROETHENE	NA	NA	5 U	NA	5 U	5 U	NA
CIS-1,3-DICHLOROPROPENE	NA	NA	5 U	NA	5 U	5 U	NA
CYCLOHEXANE	NA	NA	5 U	NA	5 U	5 U	NA
DICHLORODIFLUOROMETHANE	NA	NA	5 U	NA	5 U	5 U	NA
ETHYLBENZENE	5000 U	5000 U	5 U	5 U	5 U	5 U	5 U
ISOPROPYLBENZENE	NA	NA	5 U	NA	5 U	5 U	NA
METHYL ACETATE	NA	NA	25 U	NA	25 U	25 U	NA
METHYL CYCLOHEXANE	NA	NA	5 U	NA	5 U	5 U	NA
METHYL TERT-BUTYL ETHER	NA	NA	5 U	NA	5 U	5 U	NA
METHYLENE CHLORIDE	NA	NA	5 U	NA	5 U	5 U	NA
STYRENE	NA	NA	5 U	NA	5 U	5 U	NA
TETRACHLOROETHENE	NA	NA	5 U	NA	5 U	5 U	NA
TOLUENE	5000 U	5000 U	5 U	5 U	5 U	5 U	5 U
TOTAL XYLEMES	10000 U	10000 U	10 U	10 U	10 U	10 U	10 U
TRANS-1,2-DICHLOROETHENE	NA	NA	5 U	NA	5 U	5 U	NA
TRANS-1,3-DICHLOROPROPENE	NA	NA	5 U	NA	5 U	5 U	NA
TRICHLOROETHENE	NA	NA	5 U	NA	5 U	5 U	NA
TRICHLOROFLUOROMETHANE	NA	NA	5 U	NA	5 U	5 U	NA
VINYL CHLORIDE	NA	NA	5 U	NA	5 U	5 U	NA

ug/L = micrograms per liter

U = Below Reporting Limit

B = Detected in Method Blank

J = Estimated Result

GW = Groundwater

ORIG = Original or Parent Sample

AVG = Average of Original and Duplicate

DUP = Duplicate Sample

**ATTACHMENT 5**  
**THERMAL IMAGING REPORT**

# Thermal Imaging Results



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<b>Company</b>	Tetra Tech 661 Andersen Drive Pittsburgh, PA 15220	Tester: Keith Henn and Jon Aglio Phone: 412-921-8398 E-Mail: Keith.Henn@tetrtech.com
<b>Device</b>	testo 875-2	Serial No.: 2103530
<b>Customer</b>	Lyondell Environmental Custodial Trust	Measuring Site: Former Lyondell Beaver Valley Site Route 18 Potter Township, Pennsylvania Measuring Date: 7/6/2016
<b>Task</b>	A handheld thermal imaging camera (Testo 875 series) was utilized on 7/6/16 to collect thermal images from a boat along Raccoon Creek, adjacent to the Raccoon Creek disposal area.	

---

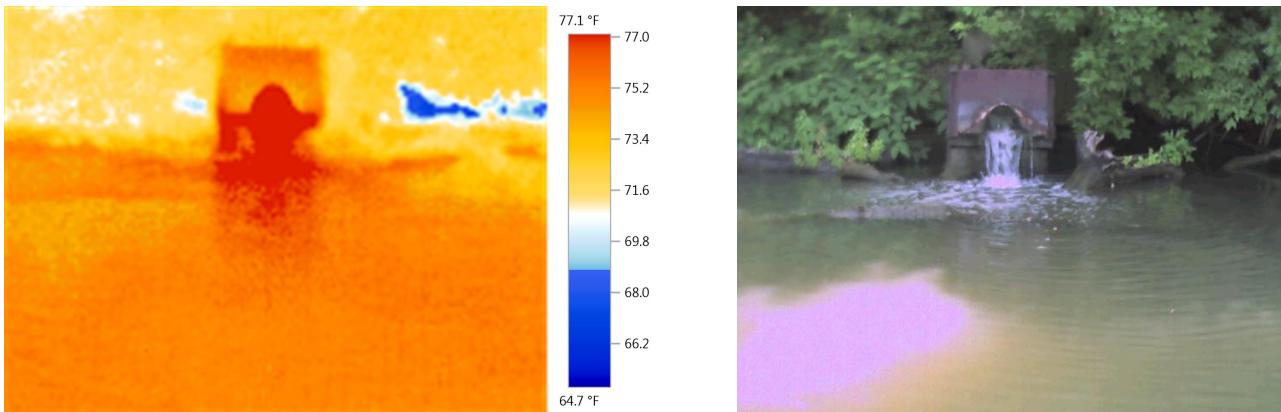


## Thermal Imaging Results

**File:**  
IV\_00798.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:37:31 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 798

BASF outfall

Temperature of water discharge at the outfall is ~80.6 degrees F.

Temperature of Raccoon Creek surface is ~75.2 degrees F.

Temperature of shaded shore line under brush cover is ~67 degrees F.

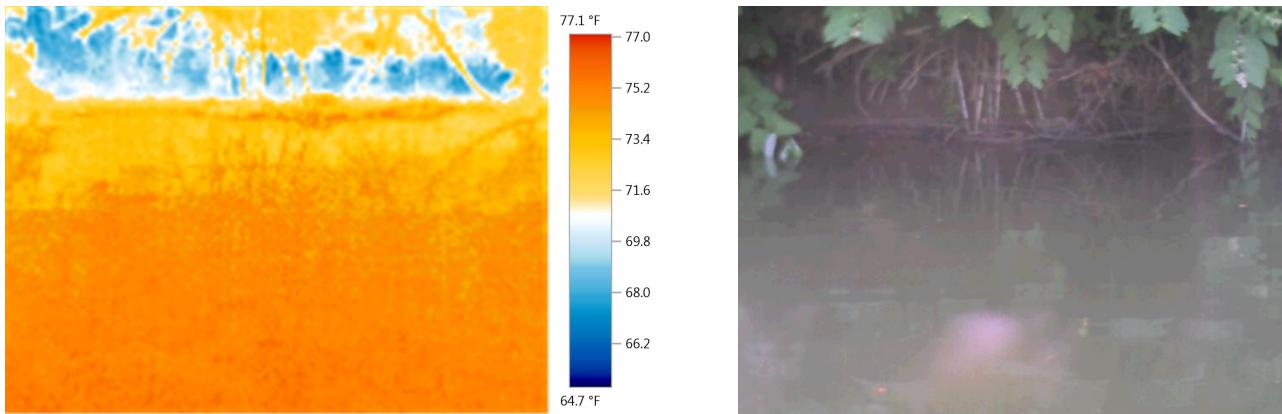
NOTE: Reflected thermal image detected on surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00799.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:39:52 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 799

Temperature of shaded shore line under brush cover is ~68 degrees F.  
Temperature of Raccoon Creek surface is ~74.9 degrees F.

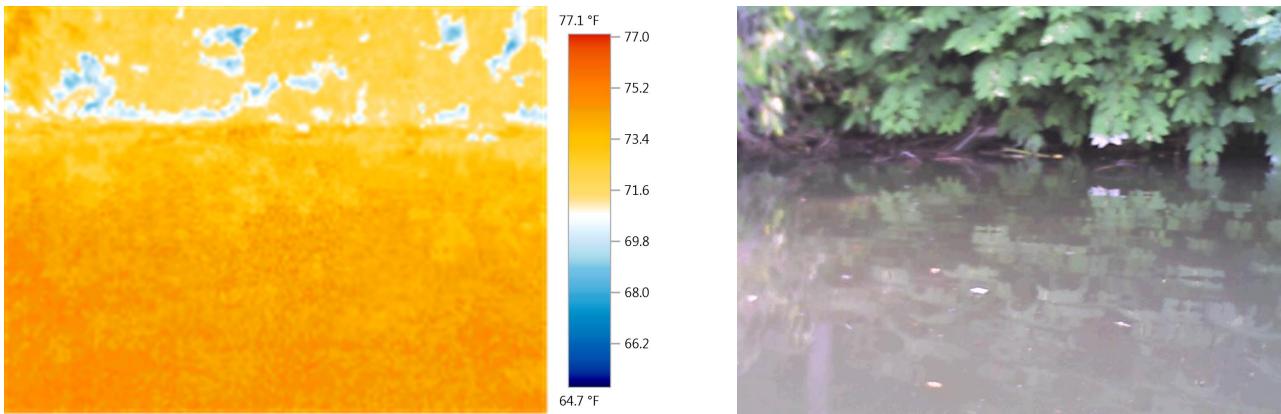
NOTE: Reflected thermal image detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00800.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:42:00 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 800

Temperature of shaded shore line under brush cover is ~69 degrees F.

Temperature of Raccoon Creek surface is ~74 degrees F.

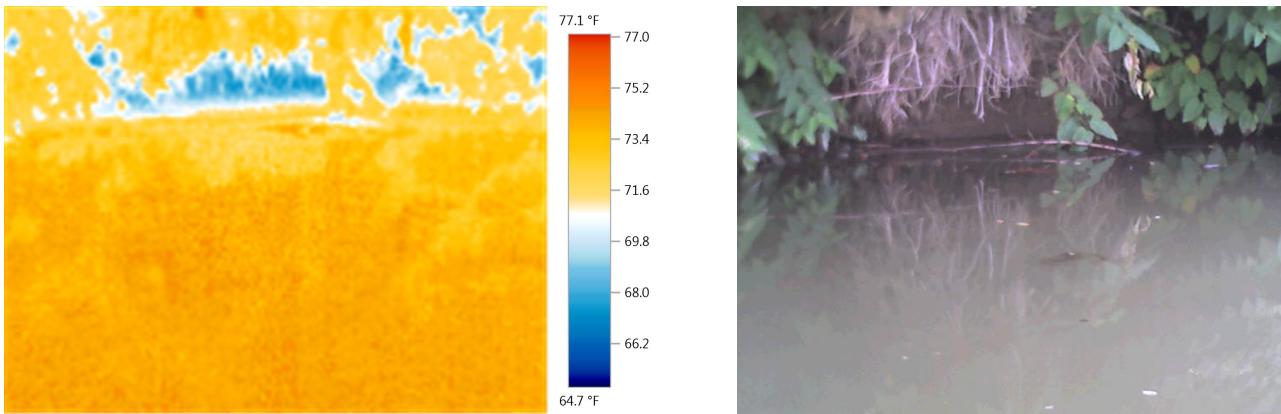
NOTE: Reflected thermal image detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00801.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:42:59 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 801

Temperature of shaded shore line under brush cover is ~69 degrees F.  
Temperature of Raccoon Creek surface is ~74 degrees F.

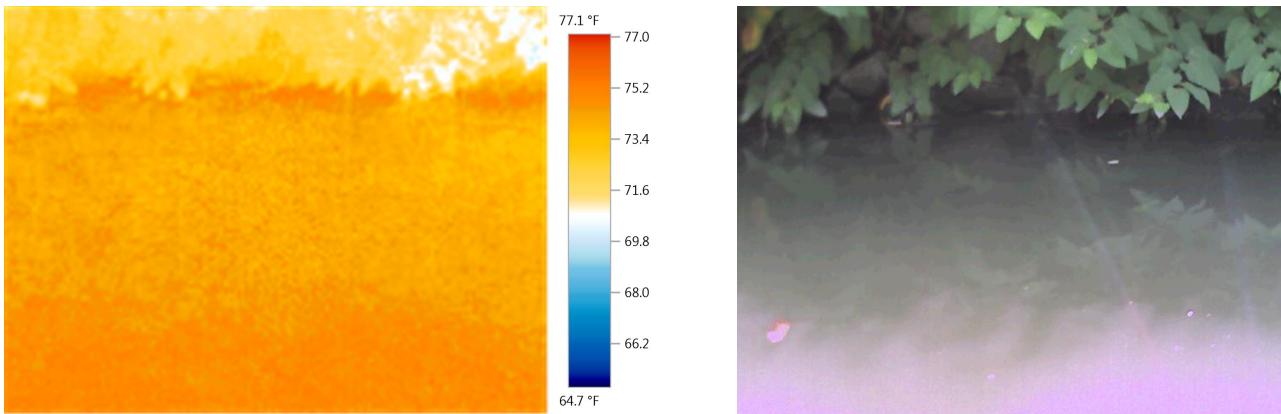
NOTE: Reflected thermal image detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00802.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:44:22 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 802

Temperature of shaded shore line under brush cover is ~70 degrees F.  
Temperature of Raccoon Creek surface is ~74 degrees F.

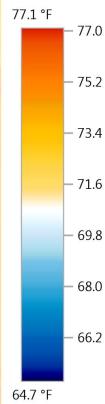
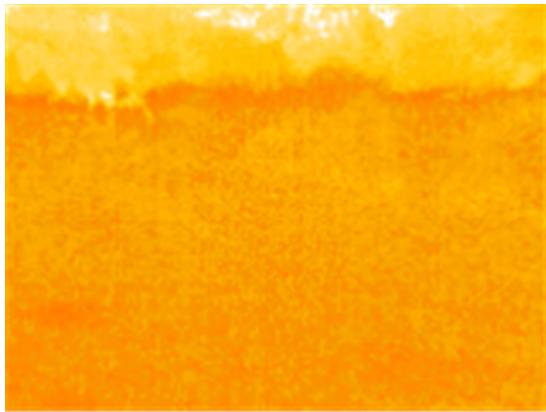
NOTE: Reflected thermal image detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00803.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:45:24 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 803

Temperature of shaded shore line under brush cover is ~70 degrees F.  
Temperature of Raccoon Creek surface is ~74 degrees F.

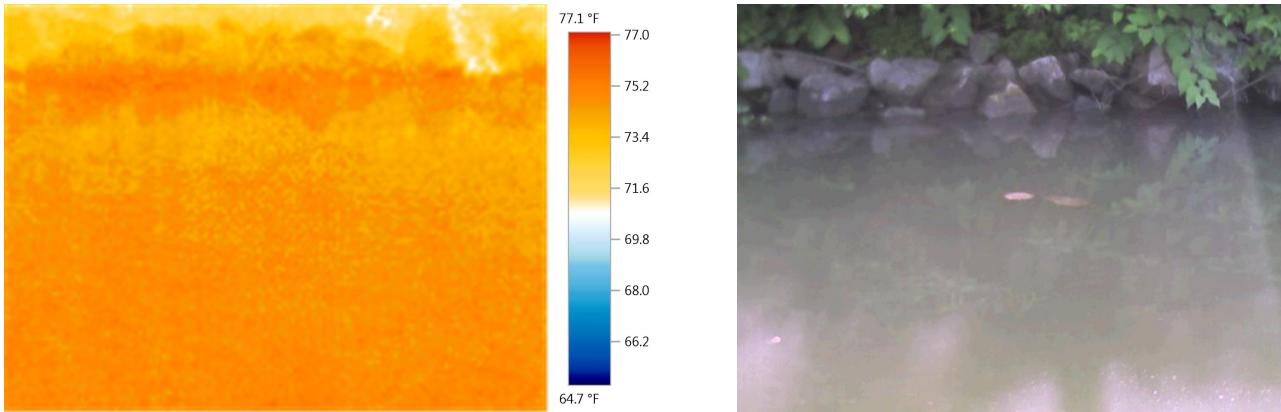
NOTE: Minor thermal image reflection detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00804.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:46:46 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 804

Temperature of shaded shore line under brush cover is ~71 degrees F.

Temperature of riprap rocks under brush cover is ~75 degrees F.

Temperature of Raccoon Creek surface is ~74 degrees F.

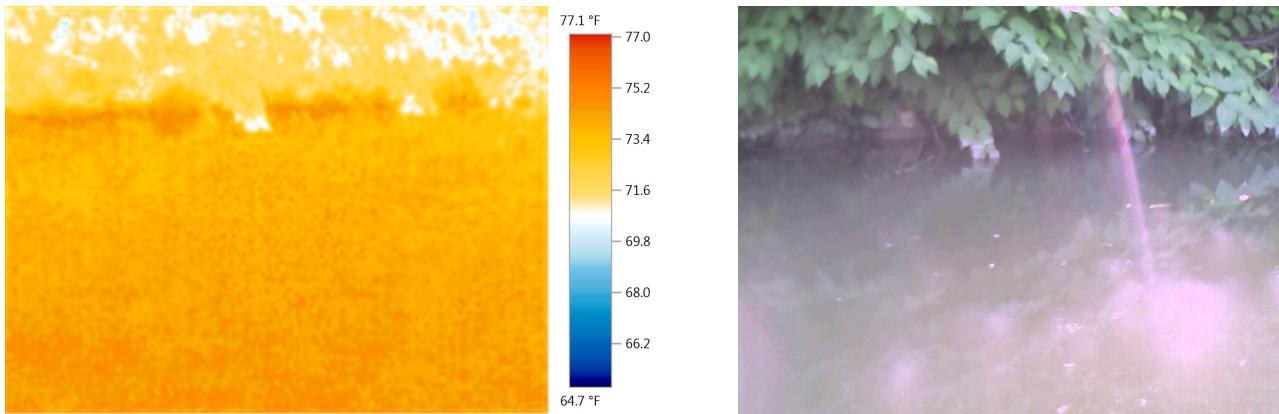
NOTE: Reflected thermal image detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00805.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:47:51 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 805

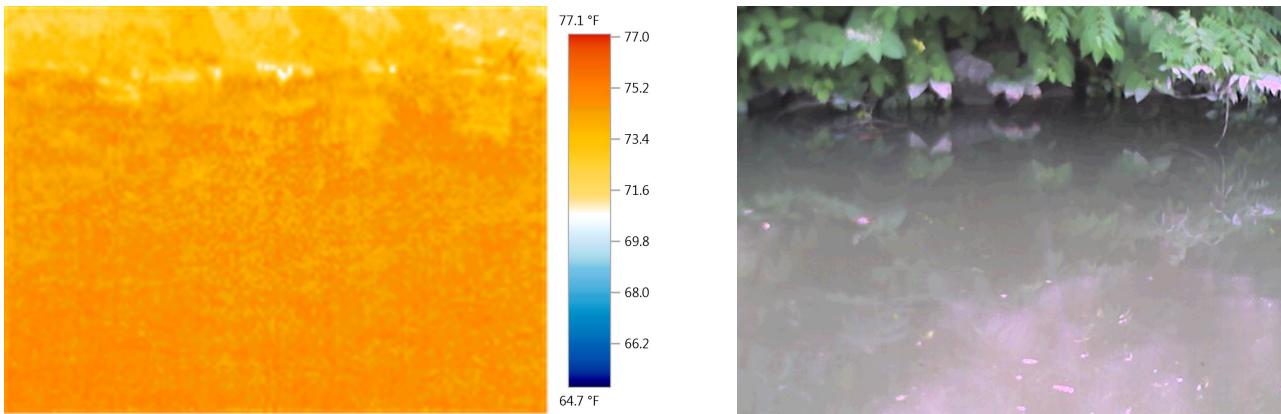
Temperature of shaded shore line under brush cover is ~70 degrees F.  
Temperature of riprap rocks under brush cover is ~74 degrees F.  
Temperature of Raccoon Creek surface is ~74 degrees F.

## Thermal Imaging Results

**File:**  
IV\_00806.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:49:14 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 806

Temperature of shaded shore line under brush cover is ~71 degrees F.

Temperature of riprap rocks under brush cover is ~74 degrees F.

Temperature of Raccoon Creek surface is ~74 degrees F.

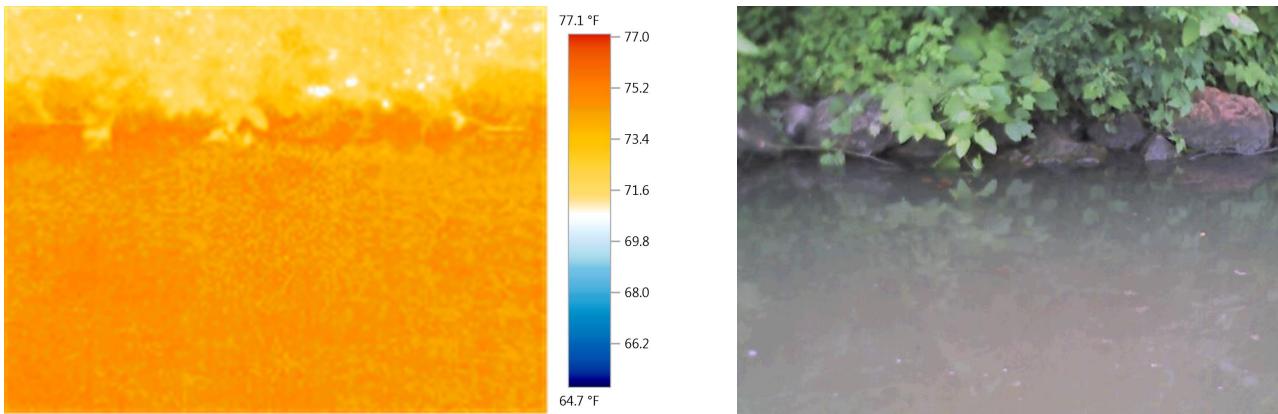
NOTE: Reflected thermal image detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00807.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:50:17 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 807

Temperature of shaded shore line under brush cover is ~70 degrees F.

Temperature of riprap rocks under brush cover is ~75 degrees F.

Temperature of Raccoon Creek surface is ~75 degrees F.

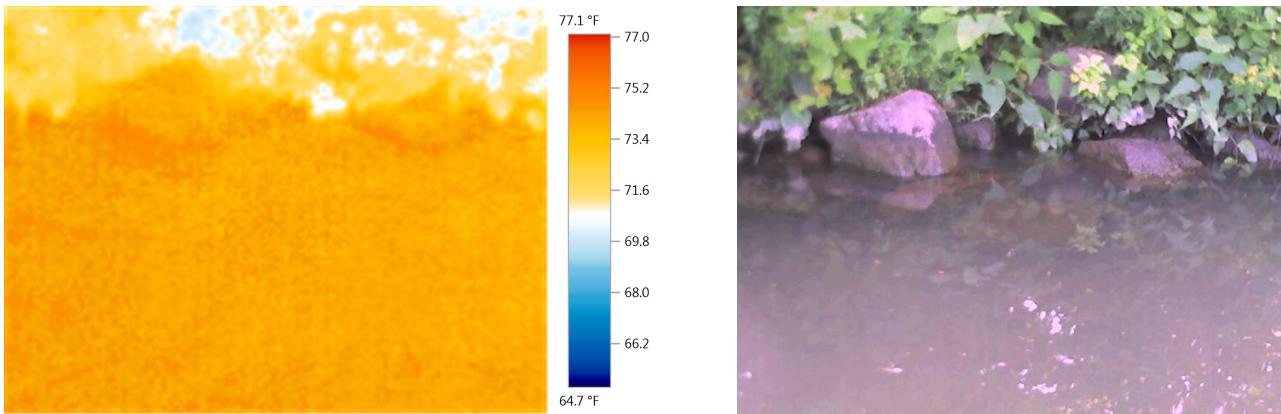
NOTE: Minor thermal image reflection detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00808.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:53:38 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 808

Temperature of shaded shore line under brush cover is ~70 degrees F.

Temperature of riprap rocks under brush cover is ~75 degrees F.

Temperature of Raccoon Creek surface is ~74 degrees F.

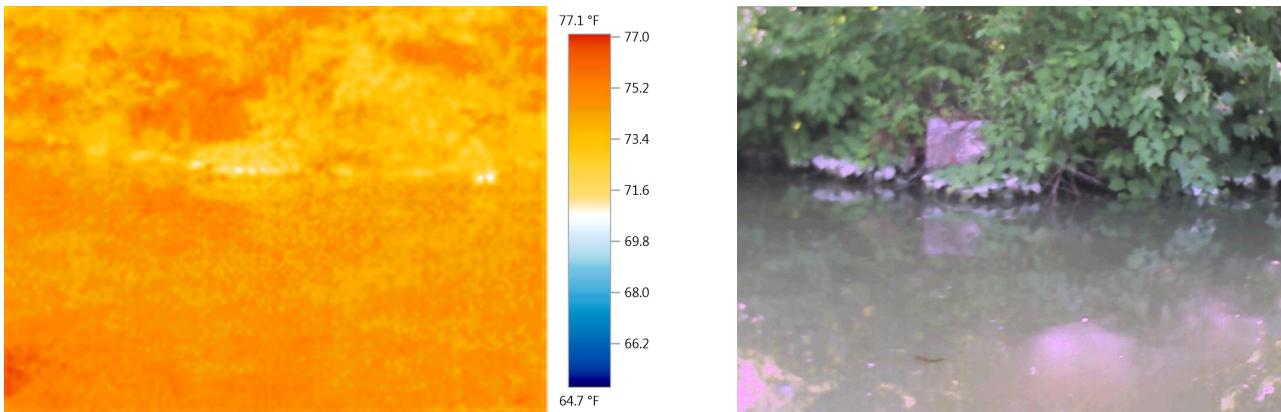
NOTE: Minor thermal image reflection detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00810.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:56:24 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image location 810

Concrete structure appears to be an outfall but no discharge observed.

Temperature of shaded shore line under brush cover is ~71 degrees F.  
Temperature of Raccoon Creek surface is ~74 degrees F.

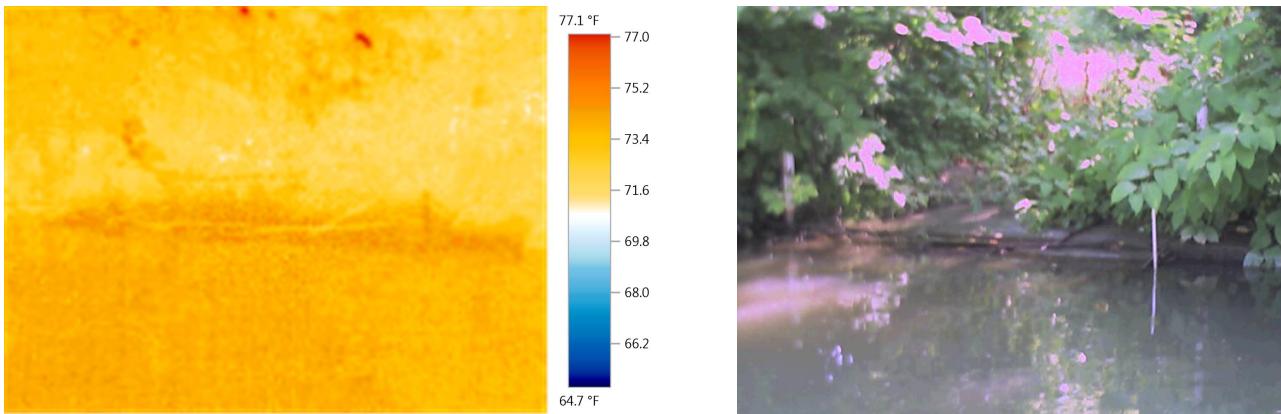
NOTE: Minor thermal image reflection detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00812.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:57:32 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image Location 812

Former "Boat Ramp" (center) and recently installed staff gage (right).

Temperature of shaded shore line under brush cover is ~72 degrees F.  
Temperature of Raccoon Creek surface is ~74 degrees F.

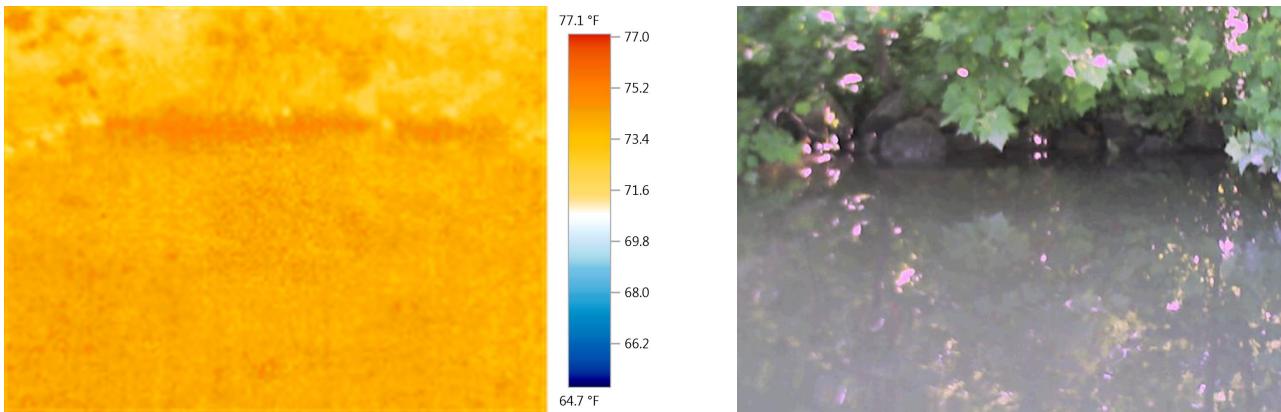
NOTE: Minor thermal image reflection detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00813.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
9:58:50 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image Location 813

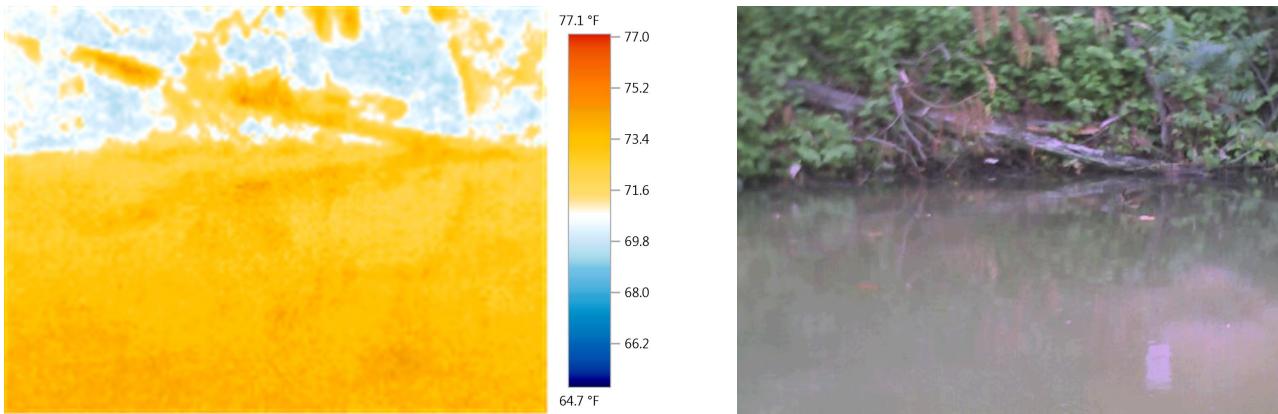
Temperature of shaded shore line under brush cover is ~74 degrees F.  
Temperature of riprap rocks under brush cover is ~75 degrees F.  
Temperature of Raccoon Creek surface is ~74 degrees F.

## Thermal Imaging Results

**File:**  
IV\_00814.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
10:00:27 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image Location 814

Temperature of shaded shore line under brush cover is ~70 degrees F.

Temperature of fallen tree is ~75 degrees F.

Temperature of Raccoon Creek surface is ~73 degrees F.

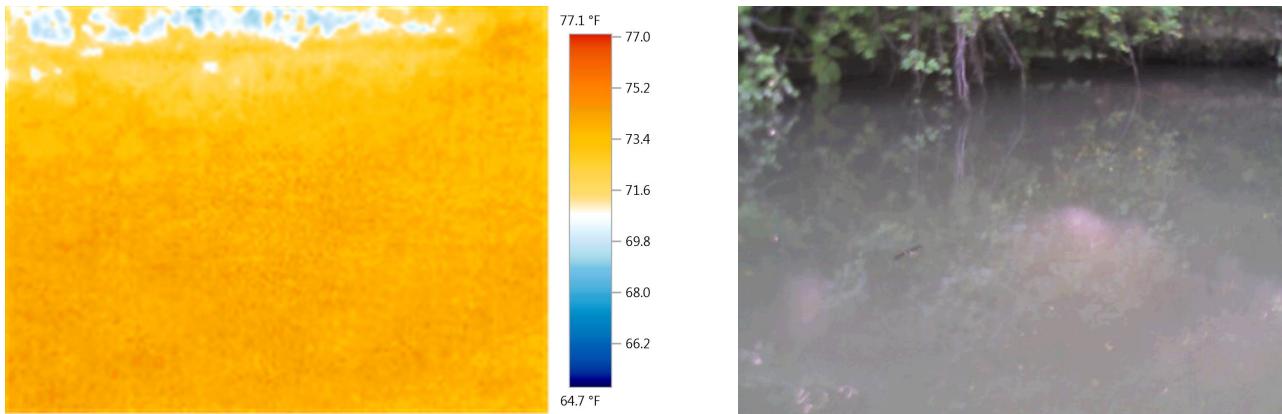
NOTE: Thermal reflection of tree evident on surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00815.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
10:01:33 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**  
Image Location 815

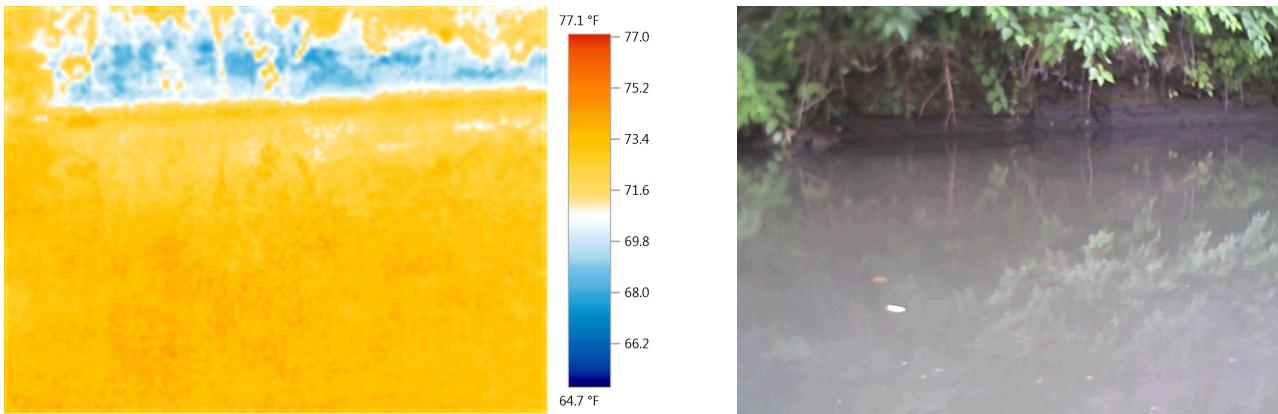
Temperature of shaded shore line under brush cover is ~70 degrees F.  
Temperature of Raccoon Creek surface is ~74 degrees F.

## Thermal Imaging Results

**File:**  
IV\_00816.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
10:02:45 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image Location 816

Temperature of shaded shore line under brush cover is ~68 degrees F.  
Temperature of Raccoon Creek surface is ~74 degrees F.

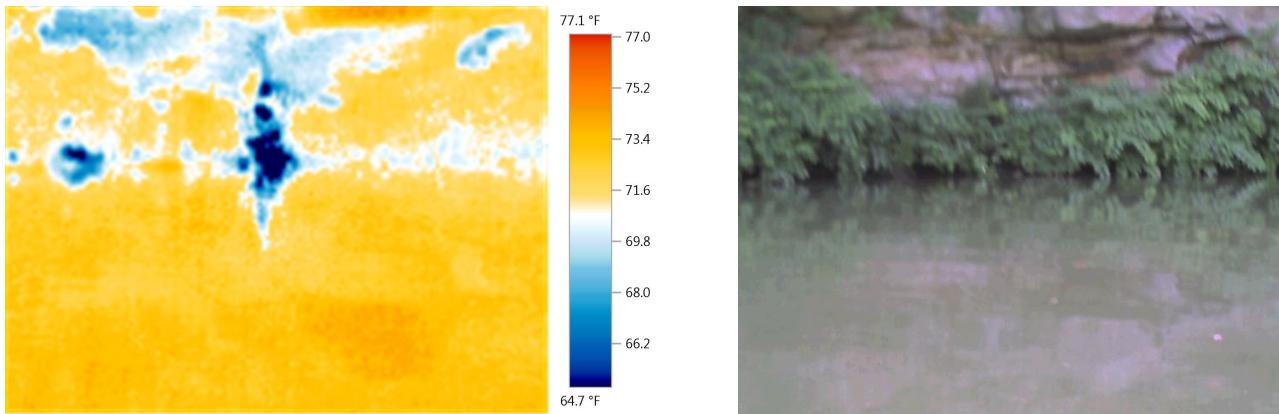
NOTE: Reflected thermal image detected on the surface of Raccoon Creek.

## Thermal Imaging Results

**File:**  
IV\_00818a.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
10:04:51 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image Location 818

Temperature of shaded rock overhang is ~69 degrees F.

Temperature of seep along rocks is ~61 degrees F.

Temperature of Raccoon Creek surface immediately below seep is ~66 degrees F.

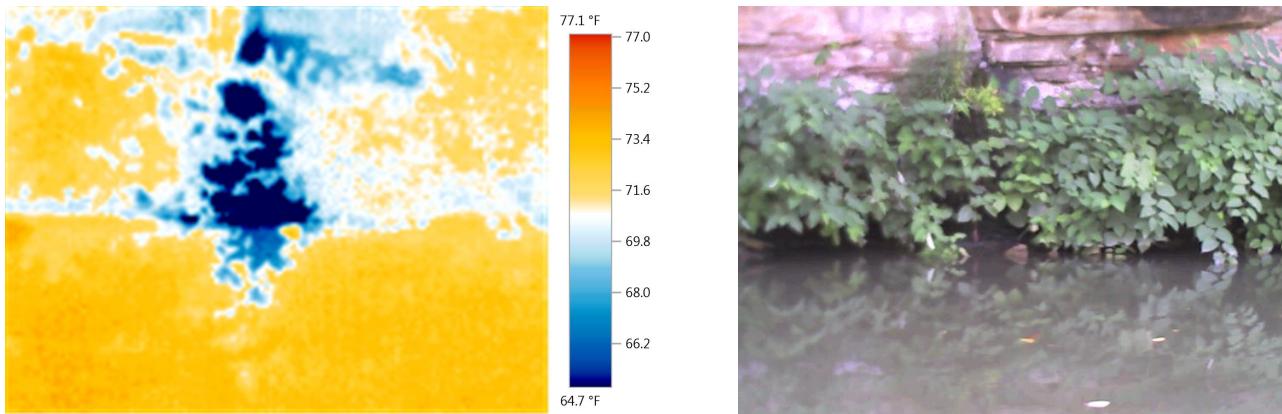
Temperature of Raccoon Creek surface immediately below seep is ~73 degrees F.

## Thermal Imaging Results

**File:**  
IV\_00818b.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
10:06:36 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image Location 818

Temperature of shaded rock overhang is ~69 degrees F.

Temperature of seep along rocks is ~56 degrees F.

Temperature of Raccoon Creek surface immediately below seep is ~66 degrees F.

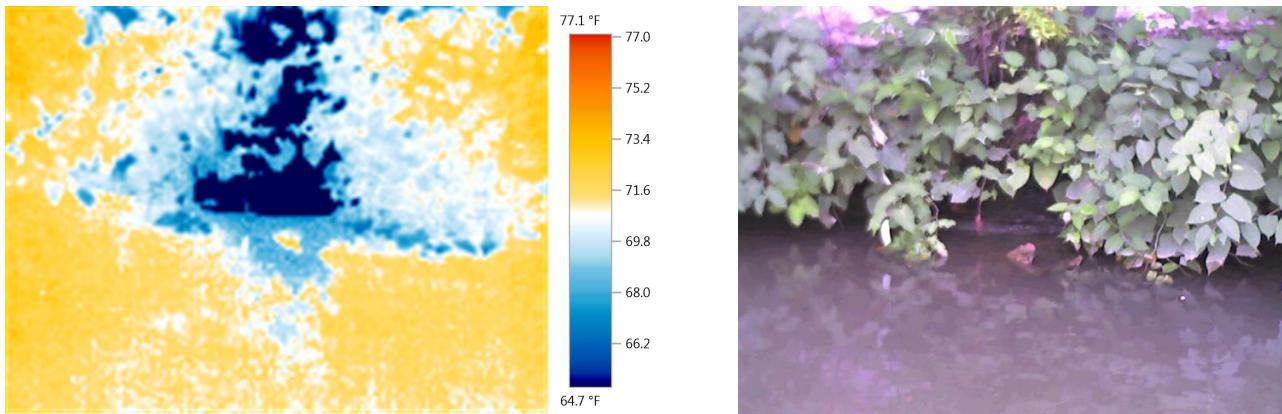
Temperature of Raccoon Creek surface immediately below seep is ~73 degrees F.

## Thermal Imaging Results

**File:**  
IV\_00818c.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
10:09:51 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**

Image Location 818

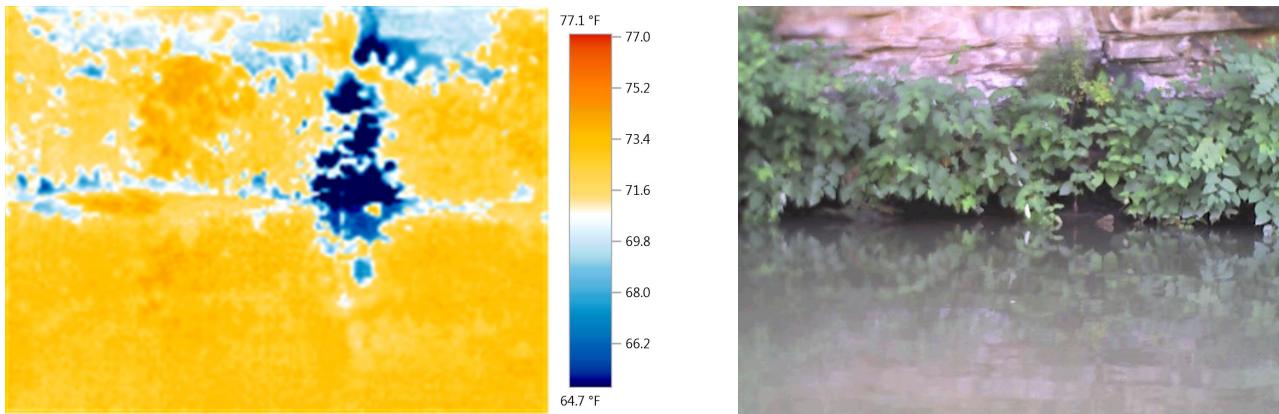
Temperature of seep along rocks is ~54 degrees F.  
Temperature of Raccoon Creek surface immediately below seep is ~68 degrees F.  
Temperature of Raccoon Creek surface immediately below seep is ~73 degrees F.

## Thermal Imaging Results

**File:**  
IV\_00818d.BMT

**Date:**  
7/6/2016

**Measuring Time:**  
10:10:57 AM



**Picture parameters:**

**Emissivity:** 0.93  
**Refl. temp. [°F]:** 68.0

**Remarks:**  
Image Location 818

Temperature of shaded rock overhang is ~70 degrees F.  
Temperature of seep along rocks is ~56 degrees F.  
Temperature of Raccoon Creek surface immediately below seep is ~66 degrees F.  
Temperature of Raccoon Creek surface immediately below seep is ~73 degrees F.

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7/12/2016 ,

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Keith Henn and Jon Aglio